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THESIS

THE EFFECT OF THE GLOBAL WAR ON TERROR ON RETENTION OF MARINE CORPS AVIATORS

by

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March 2006

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ABSTRACT

This thesis analyzes the retention of Marine Corps aviators before and after 9/11/2001. The retention analysis utilizes data from the Marine Corps' Total Force Data Warehouse (TFDW), the Defense Manpower Data Center (DMDC) PERSTEMPO file, and Aviation Information Resources (AIR), Inc. The retention analysis focuses on how the increased operational tempo resulting from the Global War on Terror has affected the retention behavior of Marine aviators. Results indicate that the deployments resulting from the increased operational tempo post-9/11 have a negative effect on the retention of Marine aviators, as compared to the period before 9/11. The post-9/11 analysis reveals that as the number of deployments increases, non-hostile or hostile, the likelihood of retention decreases. Whereas Pre-9/11 aviators were not affected by deployments, the GWOT aviators have an increasingly negative response to deployments. This thesis provides several recommendations for reducing the effect of increased deployments on retention.

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I. INTRODUCTION AND BACKGROUND

A. INTRODUCTION

The military has historically had a problem with retaining aviators. This has been primarily due to the draw of the commercial airline industry and the monetary incentives offered by that industry. In order to stem the flow of aviators into the commercial sector, the military introduced the Aviation Continuation Pay (ACP) program as the primary tool to increase retention among mid-career aviators. ACP has been relatively successful at enabling the services to maintain an appropriate number of mid-career aviators. However, the success of the ACP program as a retention tool has not been demonstrated in wartime.

Prior to the Global War on Terror, the Marine Corps deployment schedule was relatively stable with an aviator expecting to deploy six out of every 32 months. The stability of the deployment schedule allowed Marines to plan for deployments and limited the amount of flexibility required by an individual Marine. The operational stability also allowed for a more stable home life for Marines, which positively affected both the morale of the Marines as well as that of their families.

Since September 11, 2001, however, the United States has been engaged in combat operations in Afghanistan and Iraq as part of the Global War on Terror. Because of the Global War on Terror (GWOT), the operational tempo (OPTEMPO) and deployment tempo have increased dramatically. Today a Marine aviator can expect to be deployed seven out of every fourteen months. These frequent and lengthy deployments are difficult for both Marines and families. The increased OPTEMPO has caused many Marines to take a hard look at the impact the Marine Corps lifestyle has on their personal lives.

In order to determine whether the current retention tools needed to be reviewed, a new study of the retention of Marine aviators post-9/11/2001 is necessary. The Marine Corps will be able to take the results of this study and determine if it needs to be

concerned with the retention of these aviators. This information will be helpful to decision making in determining whether to adjust the current ACP program or to look for other programs to improve retention of Marine aviators.

B.   BACKGROUND

1.   Marine Corps Aviation

a.   *Marine Corps Aviator Training*

Marine Corps aviation consists of both pilots and naval flight officers. After commissioning, all Marine Corps officers complete a six-month training program called The Basic School at Marine Corps Base (MCB) Quantico, VA. Following completion of The Basic School, all officers selected for the naval aviator and naval flight officer programs are sent to NAS Pensacola, FL, for flight training.

All aviation candidates begin training with a six-week Aviation Preflight Indoctrination (API) course. This course teaches the students the basics of aerodynamics, navigation, and aircraft engines.(Chief of Naval Air Training 2) Following API, the students begin their specific training as either a Student Naval Aviator or Student Naval Flight Officer.

Student Naval Aviators (SNAs) receive training in one of three locations: Naval Air Station (NAS) Whiting Field, FL; NAS Corpus Christi, TX; or Vance Air Force Base (AFB), OK. SNAs receive 22 weeks of Primary Flight Training during which time the students are instructed in flying single engine airplanes.(Chief of Naval Air Training 2) Following completion of this training, SNAs determine which type of aircraft they want to fly; choosing between Strike (Jet), Multi-Engine Propeller, or Helicopters.(Chief of Naval Air Training 2)

The SNAs selecting Strike (Jet) training report to either NAS Kingsville, TX, or NAS Meridian, MS, for Intermediate and Advanced Flight Training.(Chief of Naval Air Training 2) This training lasts approximately one year, at the end of which the SNA receives his "wings of gold" and is designated as a Restricted Naval Aviator. At this time, the newly winged pilot selects a specific platform: the AV-8B Harrier, F/A-18 Hornet, or EA-6B Prowler.

After selecting a platform, the new pilot will report to the Fleet Replacement Squadron (FRS) for platform-specific training. This training lasts six months to one year. At the completion of training, the pilot is designated as an AV-8B, F/A-18, or EA-6B pilot and is sent to his first Fleet Marine Force (FMF) squadron. At the squadron, the pilot continues training in order to receive mission qualifications, which allow the pilot to deploy with the squadron.

The SNAs selected for Multi-Engine Propeller training receive Intermediate Flight Training at their Primary Flight Training Squadron for approximately six weeks, then report to NAS Corpus Christi for Advanced Flight Training.(Chief of Naval Air Training 2) Advanced Flight Training lasts approximately six months, at the completion of which, SNAs are designated Restricted Naval Aviators and are sent to the C-130 Hercules FRS in Georgia for platform specific training. At the completion of this training, the new C-130 pilots report to FMF squadrons for advanced training. At the squadron, these pilots receive training until designated fully combat qualified, at which time, they are considered eligible for deployment.

The SNAs selected for Helicopter training receive Intermediate Flight Training at their Primary Flight Training Squadron for approximately six weeks. Following completion of Intermediate Flight Training, the SNAs report to NAS Whiting Field in order to begin Advanced Flight Training.(Chief of Naval Air Training 2) After approximately six months of training, the SNAs are designated Unrestricted Naval Aviators and select platforms: AH-1W Cobra, UH-1N Huey, CH-46E Sea Knight, CH-53D Sea Stallion, or CH-53E Sea Stallion. At this time, pilots report to the appropriate FRS for platform specific training. Once this training is complete, they will report to FMF squadrons for further training. Once properly trained and designated as fully combat capable, they are eligible to deploy.

After API, all Student Naval Flight Officers (SNFOs) remain at NAS Pensacola for Primary Flight Training. During Primary Flight Training, the SNFOs learn the basics of flying as well as navigation. Upon completion of Primary Flight Training, SNFOs select either Tactical Jet or Strike training. These SNFOs receive Intermediate Flight Training at NAS Pensacola and then split up for Advanced Flight Training.

Those selecting Tactical Jet remain at NAS Pensacola for Advanced Flight Training. Those who select Strike report to Corry Station, FL, for Electronic Warfare Training.(Chief of Naval Air Training 2) At the completion of either Advanced Flight Training or Electronic Warfare Training, the SNFOs are designated as either Weapons Systems Officers (WSOs) for the F/A-18 Hornet or Electronic Counter-Measures Officers (ECMOs) for the EA-6B Prowler. After designation, these officers report to their respective FRS's for platform-specific training. At the completion of this training, the officers report to FMF squadrons for training. Once they are designated as fully combat capable, they are eligible for deployment.

Marine Corps Aviators endure an extensive training program, which begins with six-months of training at The Basic School. After The Basic School, a pilot can expect to spend between two and three years in flight school, while an NFO spends twelve to eighteen months. For naval aviators/flight officers, training continues for another one to two years before they are ready to deploy. At this time, the Marine Corps has made a large financial investment and is ready to receive its payback.

b. Marine Corps Aviation Active Duty Service Obligation

The Active Duty Service Obligation (ADSO) for Pilots and NFOs is different from other Marine Officers. The typical Marine Officer has an ADSO of four years after commissioning, or five years for Service Academy graduates. This commitment begins the day that the Marine reports to The Basic School. Marine Pilots/NFOs have a much greater ADSO, which does not begin until after the completion of flight school and designation as Naval Aviators or Naval Flight Officers.

Prior to 1978, the ADSO for pilots was 3.5 years and 3 years for NFOs. This would make the total commitment for these officers approximately equal to that of ground officers. This length of service commitment has been adjusted four times since 1978. The reason for adjusting the ADSO is because the Marine Corps recognizes the value of the training these officers receive as well as the value of the experience that these officers obtain through their tours with FMF squadrons. The only way to gain

experience is through time in a squadron. Due to the length of training, the Marine Corps did not get the same amount of experience from aviators as it did from ground officers at the expiration of ADSO.

In 1978, the ADSO changed to a four-year obligation. In 1981 and 1989, the ADSO changed again, to mandate an obligated service length of 4.5 and 5 years respectively. Then in 1990, the Marine Corps realized the true value of these officers and adjusted the ADSO for a final time. Since this change in 1990, all jet pilots have an ADSO of eight years after receiving their wings, and all multi-engine propeller pilots, helicopter pilots, and naval flight officers have an ADSO of six years after receiving their wings.

The change in length of ADSO was a necessity for the Marine Corps. Pilots and NFOs receive training that is not only valuable to the military, but also valuable to the civilian airline industry as well. With shorter ADSOs, individuals were essentially encouraged to use the military to pay for expensive flight training as well as experience with no vested interest in the service. As a result, many pilots separated in order to pursue careers in the commercial airline industry. Many of these pilots had served less than eight years of active service and had obtained valuable experience. When faced with the knowledge of twelve more years of service (in order to receive a pension), more deployments, and relatively low pay, many of these officers took advantage of the training and experience received, and separated from the Marine Corps.

The current length of the ADSO for pilots and naval flight officers, enhances the draw of investiture in the military. Jet pilots, who are the most marketable to the civilian airline industry, are obligated to serve eight years after completing flight school. When time-to-train is taken into account, jet pilots will have eleven or twelve years of service at the end of their obligated service. The vestment of the pension is much greater when an individual is "over the hump" and more than halfway to retirement.

Multi-engine propeller or and helicopter pilots face a similarly difficult decision. With the current ADSO at six years, these pilots will have nine or ten years of

commissioned service at the completion of their obligation. At this point, the lure of vestment is stronger than it had been under previous ADSOs, and more individuals will consider continuing service as the best career decision.

The Active Duty Service Obligation has changed over the years in order to meet the needs of the Marine Corps. The Corps cannot afford to lose officers that it has spent hundreds of thousands of dollars to train. Because of the nature of the general training that pilots and naval flight officers receive, they are in demand by the civilian sector. The Marine Corps has had to accept that reality and make changes in order to retain these individuals. One method of increasing retention has been to increase the Active Duty Service Obligation.

c. Aviation Continuation Pay (ACP)

Aviation Continuation Pay (ACP) was first introduced enacted into law in 1989 with the passing of Title 37 U.S. Code Section 301B. This law was enacted in order to "provide a proactive, long-term aviation career incentive for…aviation field grade officers."(CMC MPP 1995) The Marine Corps first made use of ACP in Fiscal Year (FY) 1990 and has continued offering it since that time. The initial offering of ACP was for a short-term contract (two years) which did not necessarily help the Marine Corps to meet the ACP goal of providing a "long-term aviation career incentive."(CMC MPP 1995,) The two-year contract only served to meet short-term needs, not long-term needs.

From FY1990 through FY1996, the Marine Corps used ACP in order to get an additional two years of service out of its pilots. After FY1996, the Marine Corps realized it was not utilizing ACP to its fullest and modified the program. In FY1997, the Marine Corps increased the ACP obligation in order to retain aviators through 14 years of service. Aviators were eligible for ACP if they were below the rank of Lieutenant Colonel, were "qualified to perform operational flying duty, had completed any active duty service commitment incurred from undergraduate aviator training, and had completed at least six years, but less than 13 years of active duty."(CMC MPP 1997,) The requirement was "to remain on active duty to complete 14 Years of Commissioned Service (YCS)."(CMC MPP 1997,) In return for this increased service commitment, the aviator would receive an ACP payment of $12,000 annually. The monetary incentive

was intended to balance out the inequity between civilian aviator pay and military aviator pay. The theory is that money is the most productive incentive and that aviators will respond to this monetary incentive.

The ACP for FY1997 included two "critical" Military Occupational Specialties (MOS's), but in future years the Marine Corps expand the program by designating all aviation MOS's as "critical." Other changes have occurred since FY1997, with respect to ACP.

In FY2001, the Marine Corps realized that the previous programs were not helping it to meet the goal of being a "long-term aviation career incentive"(CMC MPP 1995,) and determined to make the necessary changes. FY2001 ACP extended the required length of service to 16 years for Majors and 21 years for Lieutenant Colonels.(CMC MPP 2000,) It also created a short-term contract and a long-term contract. The short-term contract required the aviator to remain in service for a three-year period ("unless the officer has less than three years remaining to complete 16 YCS"(CMC MPP 2000,)) and was offered to both Majors and Lieutenant Colonels (who were committed to 21 YCS). The long-term contract was offered only to Majors who were willing to agree to serve until 16 YCS.(CMC MPP 2000,) The monetary incentive varied between the short-term and long-term contracts, and it also varied between the types of aircraft flown. Fixed-Wing pilots received a higher incentive than Rotary-Wing Pilots and Naval Flight Officers. The Fixed-Wing payment was $18,000 per year for the short-term contract and $25,000 per year for the long-term contract. While all other aviators received $9,000 per year in the short-term, and $12,000 per year in the long-term.(CMC MPP 2000,)

ACP remained unchanged between FY2001 and FY2003. The Marine Corps believed that ACP was successfully enabling it to retain the appropriate number of aviators, and that some communities were even retaining too many officers. In FY2004, the Marine Corps changed ACP by reducing the amounts offered annually to Rotary Wing Pilots and Naval Flight Officers.(CMC MPP 2003) FY2005 saw another change to ACP, with Lieutenant Colonels no longer qualifying for the bonus.(CMC MPP 2004)

These changes were undertaken because of a belief that retention was high and that the Corps had more field-grade aviators than it needed.

The intent behind ACP is to entice aviators to remain in the Marine Corps for a career. At the time that ACP was initiated, all of the services were suffering from a shortage of senior leadership in their respective aviation communities, particularly with field-grade officers (Majors and Lieutenant Colonel). More and more aviators were leaving the service because of the enticement of better pay in the civilian airline industry. As long as the airlines were hiring, aviators would be leaving. The services determined that the best incentive to retain aviators was a monetary incentive, such as ACP. This incentive would serve to offset the imbalance between civilian aviator pay and military aviator pay. It is not possible for the military to completely equalize aviator pay with their civilian counterparts, so it is acknowledged that there will be a number of pilots separating in order to pursue more money in the civilian sector. The goal of ACP is to entice those aviators who are "on the fence" and enjoy military service, but are considering options in the civilian marketplace.

ACP has been successful in meeting the needs of the services by enticing aviators to remain, but the times have changed. When ACP was enacted, the United States was not at war. Since then, the United States has entered into the Global War on Terror, with direct combat in Afghanistan and Iraq, and increasing deployment tempo. While ACP was successful during peacetime, the question remains "will it be successful during a time of war?"

2. Personnel and Operational Tempo (OPTEMPO)

The Fiscal Year 2000 National Defense Authorization Act defined Personnel Tempo (PERSTEMPO) and Operational Tempo (OPTEMPO) for the Department of Defense. The reason for these definitions is to limit the deployed time for soldiers, sailors, airmen, and Marines on active duty. In 1999 when this legislature was passed, the military was active in Bosnia, Kosovo, Africa, and other places throughout the world. At the time, the military appeared to be stretching itself too thin. With the Global War on Terror, this belief has turned into a reality. Because of this, it is necessary to understand the definitions of Personnel Tempo and Operational Tempo as legislated.

Personnel Tempo is defined as "the amount of time members of the armed forces are engaged in their official duties, including official duties at a location or under circumstances that make it infeasible for members to spend off-duty time in the housing in which the member resides when on garrison duty at the member's permanent duty station."(CMC MPO-40 2000b) This definition of Personnel Tempo is meant for the individual Marine. It requires that the Marine Corps, as well as the other services, keep record of deployed days for each individual Marine.

In 2000, the Commandant of the Marine Corps gave further guidance with respect to PERSTEMPO. This guidance covers a four-year period for each Marine. The Commandant's guidance states that:

A. Marines cannot deploy or remain deployed more than 182 days of the preceding 365 days without the approval of the first General Officer in their chain of command.

B. Marines assigned to a Combatant Command cannot deploy or remain deployed more than 220 days of the preceding 365 days without approval from their respective Marine Corps Component Commander (COMMARFORPAC or COMMARFORLANT).

C. Marines not assigned to a Combatant Command cannot deploy or remain deployed more than 220 days of the preceding 365 days without approval from CMC, ACMC, or the Deputy Commandant for Manpower and Reserve Affairs (DC M&RA)

D. Marines deployed more than 400 days of the preceding 730 days rate high deployment per diem payments of $100 per day beginning on the 401st day.

E. SECNAV (Secretary of the Navy) may suspend the applicability of the above mandates when it is determined that such a waiver is necessary in the national interests of the United States. (CMC MPO-40 2000a)

The FY2000 National Defense Authorization Act defines Operational Tempo as "the rate at which units of the armed forces are involved in all military activities,

including contingency operations, exercises, and training deployments."(CMC MPO-40 2000b) This definition does not apply to the individual, it applies at the unit level. This requires the Marine Corps, as well as the other services, to track all unit-level deployments.

3.   Retention

Retention has always been a concern for the aviation community. Many military pilots have succumbed to the lure of the big paycheck and stable lifestyle offered by the civilian airlines. The civilian airlines are in sharp contrast to the military, which offers a relatively smaller monetary compensation package and frequent and long deployments.

Because of the retention problem, the services were forced to offer Aviation Continuation Pay (ACP) in an effort to equalize the pay differential between military and civilian pilots. ACP helps to slow down the losses, but with the continuous high OPTEMPO and PERSTEMPO, retention remains a concern.

Every year the Deputy Commandant for Manpower and Reserve Affairs testifies before Congress concerning military personnel issues, specifically recruiting and retention. Historically, aviator retention is stable, with only fixed-wing pilots being of major concern. Testifying prior to the attacks on the World Trade Center, on 24 April 2001, Major General Terrence Murray, USMC, Assistant Deputy Commandant for Manpower and Reserve Affairs testified that: "Pilot retention remains a concern. The FY01 ACP Plan has had mixed results…Rotary Wing Pilot and Naval flight officer 'take rates' for ACP have met aggregate retention targets for these communities. Fixed wing pilot 'take rates', while improved over previous years, have not met retention targets that increased to compensate for the number of previous losses due to civilian airline hiring."(Murray, Terrence P., MajGen, USMC and Parks, Gary L., MajGen, USMC 2001, 1) And in March of 2004, with the Marine Corps heavily deployed in support of the Global War on Terror, Lieutenant General Garry Park, USMC, reported to Congress that while the Marine Corps is successfully retained Rotary Wing Pilots and NFOs, there is still a lack of Fixed Wing Pilots.(Parks, Garry L., LtGen, USMC and Huly, Jan C., LtGen, USMC 2004, 1)

It should be noted that the Marine Corps defines retention of aviators based upon "take rates" of ACP. This means that aviators are considered to be retained if they accept ACP and the obligated service extension. The typical definition of retention is survival to either one or two years past the Expiration of Active Obligated Service (EAOS). The Marine Corps is not interested in retaining aviators for one or two years past EAOS; it wants to retain aviators into the ranks of Major and Lieutenant Colonel.

With the war continuing and the change in deployment cycles, retention is going to continue to be an issue. In speaking before Congress in April of 2005, Lieutenant General H.P. Osman, USMC, Deputy Commandant for Manpower and Reserve Affairs, reported that the deployment cycle for Marines has changed significantly since the Global War on Terror. Prior to GWOT, the deployment cycle was six months deployed followed by eighteen months home. Since GWOT, the deployment cycle has increased to seven months deployed followed by seven months home.(Osman, H.P., LtGen, USMC 2005)

The Marine Corps deployed 25,000 Marines to Iraq in 2004 while conducting operations in Haiti, Afghanistan, South Asia (tsunami relief), and the Horn of Africa.(Osman, H.P., LtGen, USMC 2005)   Since 2000, Marines have deployed to Kosovo, Afghanistan, Cuba, the Philippines, the Horn of Africa, the Republic of Georgia, Iraq, EUCOM, Nigeria, Honduras, and South Asia.(Anonymous2005, 294) With such high OPTEMPO and PERSTEMPO, retention is of major concern to the Marine Corps.

C.   PURPOSE OF THE STUDY

This study will provide the necessary information required to determine whether a retention issue currently exists amongst mid-career Marine Corps aviators. If a retention issue does exist, the Marine Corps will have the information necessary to warrant a look at the Aviation Continuation Pay program and other retention tools.

D.   RESEARCH QUESTIONS

The primary research question is whether the increased operational tempo and personnel tempo caused by Global War on Terror has affected the retention of Marine Corps aviators. Secondary research questions are:

- Is there a difference in the GWOT retention effect based upon the type of aviator?

- What steps do the Marine Corps need to take in order to meet future requirements for aviators?

II. LITERATURE REVIEW

A. TURNOVER

The Department of Defense is implementing better business practices in order to improve efficiency and reduce costs. One of the practices that must be considered concerns retention. Retention is a concern for businesses around the world and has become a focus for improvement in the business sector. Firms do not want to see turnover increase because of the costs of recruitment, lost productivity, new-hire training, and lost knowledge.(McDonald 2005, C2) Because of these costs, the overall cost for turnover can be as much as one half to two times the annual salary of the position needing to be filled.(McDonald 2005, C2)

Private firms must be concerned with turnover and retention. According to Thomas Leppert, CEO of Turner Corporation, "The No.1 issue for us is people – finding good, strong people with the right education and training and being able to retain them."(Stribling 2005, 74) If private business is concerned with retention of personnel, then the Department of Defense must also be concerned.

The Society for Human Resource Management (SHRM) cites the following as reasons for employee turnover: better compensation elsewhere, career opportunities elsewhere, dissatisfaction with current organization, burnout, and feeling unappreciated.(Anonymous2005, 3) These issues should not just be concerns of private business, but they must also be concerns of the government, particularly the Department of Defense. Military service members are concerned with many of the same issues private business employees are concerned with; compensation being one of the key issues. Many service members choose to remain because of a "higher calling." However, this call to duty is increasingly overshadowed by the other concerns cited. Due to the on-going Global War on Terror, service members are being deployed at rates higher than those seen since the Vietnam War. Because of this increased OPTEMPO, many service members are feeling burnt out and underappreciated, not only by the government, but also unappreciated by the American public.

The Department of Defense must be concerned about retention and turnover of personnel. The aviation community is one small piece of the DoD personnel picture, but it is one historically affected by retention. The costs of recruiting, training, lost productivity, and lost knowledge are all reasons why the DoD must be concerned with aviator retention. The costs for training aviators is high; not just initial flight training, but also tactical training. Also, when an aviator departs, he takes with him professional knowledge that cannot be replaced by a new hire. The lost knowledge was learned over the course of his career, and will take six or more years to replace. The productivity lost has a similar affect as the lost knowledge. When an aviator separates, there is not another fully trained aviator waiting to take his place. Instead, the experienced aviator is replaced with a new one fresh out of flight school. This new aviator must undergo extensive training in order to fully replace the productivity of the one that separated.

Because of the need for the transfer and maintenance of knowledge, the military must be concerned with turnover. The aviation community is one of the occupational fields that routinely suffers from high turnover. This is due to the highly valued general skills that aviators receive. These general skills are valuable, not only to the military, but also to the commercial aviation community. Because of this, turnover of aviators is a high interest item to all of the services.

Elliot, Kapur, and Gresenz (2004) conducted a study titled "Modeling the Departure of Military Pilots from the Services."(Elliott, Kapur, and Gresenz 2004, iii) This study evaluated data taken from the 1996-97 Exit Survey of Marine F/A-18 pilots. The four reasons cited for separation of Marine F/A-18 pilots were: 1) discrepancies in bonus compensation (compared to other services); 2) operational tempo; 3) distrust of the leadership at the Department of Defense-level; and 4) commercial airline hiring.(Elliott, Kapur, and Gresenz 2004, iii) These concerns mirror the concerns of private business mentioned earlier. They also are indicative of the concerns of the military aviation community in general.

The high operational and personnel tempo is of great concern to all Marine Corps aviators. Marine pilots deploy more frequently than Air Force pilots, who only deploy for 90-day periods(Tirpak 1997,). Marine pilots also deploy at a rate equal to or greater

than that of Navy pilots. In addition, the conditions of Marine Corps deployments are typically much harsher than those of their Navy and Air Force counterparts. These factors are likely to lead to higher frustration and dissatisfaction with Marine Corps OPTEMPO and PERSTEMPO.

Finally, the commercial airline industry can take advantage of both pay and OPTEMPO/PERSTEMPO concerns of military pilots. The commercial airline industry offers better compensation and a much lower personnel tempo. In 1997, the annual salary for a Captain in the major commercial airline industry exceeded $175,000; more than double that of a Marine Corps Major (O-4).(Elliott, Kapur, and Gresenz 2004, iii) Also, according to a RAND study, commercial airline pilots have shorter workweeks than military pilots and greater control and flexibility of work schedules.(Elliott, Kapur, and Gresenz 2004, iii) These issues make the commercial airline industry a much more attractive opportunity to military pilots, particularly Marine pilots. With the increased OPTEMPO due to the GWOT and the uncertainty about the length of the GWOT, many pilots see the commercial airline industry as an opportunity to improve their lifestyles and family situations.

B. RELATIVE PAY AND AVIATOR RETENTION

It is important to understand the relationship between pay and retention in both the civilian and military sectors. In the civilian marketplace, firms must compete with each other in order to attract the best employees. The military is forced to compete with the civilian labor market for employees. The military is hindered in its capability to compete because of Congressionally mandated pay scales. On a strictly financial basis, the civilian market is much more attractive than the military market, especially for the aviation community.

The civilian aviation community offers much greater monetary compensation than the military aviation community. The military recognizes the importance of these pay differences and has attempted to narrow the difference in compensation. While the military cannot give pilots a separate basic pay table, it does offer them incentives. The

primary incentive is Aviation Career Incentive Pay (ACIP) which is a monthly pay given to all military aviators based upon years of aviation experience. As experience increases, ACIP also increases.

The second incentive offered to aviators is Aviation Continuation Pay (ACP). ACP is offered only upon completion of the initial service obligation and is intended to entice Majors (O-4) to stay through sixteen years of service. The Marine Corps believes that by retaining an aviator through sixteen years of service, it will increase the likelihood of retention through twenty years. The Marine Corps would like to get as much service as possible out of its aviators, primarily due to the high cost associated with replacing them. The effects of both ACIP and ACP as well as the effect of pay, in general, have been the subject of numerous studies.

A study conducted by Kostiuk (1985) evaluated the effect of pay on the retention of Marine Corps aviators.(Kostiuk 1985, i) The study was intended to evaluate a career bonus for aviators (ACP). Kostiuk (1985) viewed pay as a key factor affecting retention because "aviators will choose the career that maximizes the value of discounted lifetime earnings."(Kostiuk 1985, i) Kostiuk (1985) used basic economic theory to assert that aviators will choose the career (military or civilian) which offers the best pay. The study compared the military and civilian earnings of Captains and Majors with 6-14 years of services between the years 1973 and 1982.(Kostiuk 1985, i)

Kostiuk's (1985) logistic regression model used attrition as the dependent variable and an ACOL Pay variable, the change in the number of pilots employed by civilian airlines, and dummy variables for years of service 7 through 14, as the independent variables. This simple model revealed that the Marine Corps could save training funds by paying bonuses in order to increase aviator retention.(Kostiuk 1985, i) The cost, in 1985 dollars, to train one Marine Corps pilot was $850,000.(Kostiuk 1985, i) The study showed that it would be less expensive to retain one aviator rather than to train one.

Cymrot and Byrnes (1988) conducted a study of Navy Pilot continuation rates that placed heavy emphasis on the financial aspect of the decision. The study came about as the result of the 1987 increase in the naval aviator service requirement.(Cymrot and

Byrnes 1988, i)   The dependent variable for the logistic regression model was continuation and the independent variables were net pay, civilian airline hires, unemployment rate, an interaction between net pay and being a jet pilot, and an interaction between net pay and being a prop pilot.(Cymrot and Byrnes 1988, i)   The results revealed that as the gap between military and civilian pay is narrowed, the continuation rate will increase.(Cymrot and Byrnes 1988, i)   Therefore, increasing ACP will increase the continuation rate.   The study also showed that a robust civilian airline industry or civilian economy, in general, have negative effects on Navy pilot continuation.(Cymrot and Byrnes 1988, i)

Cymrot (1989) conducted another study on the military aviation community, focusing on the implementation of the ACP program.   Cymrot (1989) selected two samples: Navy pilots and Navy NFOs.(Cymrot 1989, 3)   The study modeled continuation based on a military-to-civilian pay ratio interacted with helicopter, jet, and prop pilots, the unemployment rate for 20 year old males interacted with the three pilot communities, and civilian aviation hiring rates interacted with the three pilot communities.(Cymrot 1989, 3)   The same model was used for the Navy NFO sample.

The results of the study showed that all aviators (pilots and NFOs) are responsive to monetary incentives.   The results of both models showed that, as the gap between military and civilian pay gets smaller, continuation rates increase.   Jet pilots also appeared to be more responsive to such pay changes, while prop and helicopter pilots were similar and more responsive than NFOs.(Cymrot 1989, 3)   All aviators exhibited negative reactions to both the unemployment rate and the rate of civilian hiring.   Prop pilots were very responsive to increases in civilian hiring, while helicopter pilots were the most responsive to changes in the unemployment rate.(Cymrot 1989, 3)   The results of this study showed that continuation is affected by relative pay, and that continuation rates can be controlled with pay measures such as ACP.

C.   **OPERATIONAL / PERSONNEL TEMPO AND RETENTION**

The subject of OPTEMPO and its relationship to retention has been evaluated in numerous prior studies.   The recurring findings from these studies show that as the number of deployments increases, the likelihood of an individual choosing to stay in the

military also increases. The definition of retention varies across these studies, and there are different approaches to identify deployments. The methodology also differs between studies; some evaluate the effect of deployments, some differentiate between hostile and non-hostile deployments and others evaluate the length of time between deployments.

Cooke, Marcus, and Quester (1992) conducted a study of the effect of OPTEMPO and PERSTEMPO on enlisted retention that evaluated the retention decisions of Navy sailors between Fiscal Years 1979 and 1998. (Cooke, Marcus, and Quester 1992, i) The study defined retention as actively reenlisting or extending two years beyond EAOS. The authors omitted those individuals extending for periods less than two years.(Cooke, Marcus, and Quester 1992, i) Therefore, the individuals who were labeled as having "separated" were those who chose not to continue at EAOS. This definition of retention fails to take into account the separation decision of those who extended less than two years and later decided to separate after the initial extension.

Cooke, Marcus, and Quester (1992) specified a reenlistment model, by use of a logistic regression, in which the independent variables included race, marital status, ASVAB score, Selective Reenlistment Bonus (SRB), military-to-civilian pay ratio, unemployment rate, Navy Enlisted Classification, percentage of time underway, time between deployments, length of last deployment, and whether or not the sailor was deployed at the time of making the reenlistment decision.(Cooke, Marcus, and Quester 1992, i) The study evaluates the reenlistment decision of three groups: 1) 4-year obligors at their first reenlistment decision; 2) married 4-year obligors at their first reenlistment decision; and 3) sailors with 8-10 YOS.(Cooke, Marcus, and Quester 1992, i)

The study found similarities across all three sample groups. For all three groups, deployments increase the likelihood of reenlistment. The length of deployments were also found to play a role in the reenlistment decision. Very long deployments (greater than eight months) result in a decrease in the likelihood to reenlist as compared to sailors with either short or long deployments. Therefore, deployments greater than eight months have a negative effect on reenlistment, whereas deployments less than eight months have a positive effect. The study also found that, for all three groups, time between deployments has a negative effect on reenlistment. Those sailors experiencing shorter

time spans between deployments were more likely to reenlist than those sailors with longer time between deployments. Finally, the study found that those sailors who are deployed at EAOS are less likely to reenlist than those who were not deployed at EAOS.(Cooke, Marcus, and Quester 1992, i)

The results of this study were explained by appealing to the theories of self-selection and job matching. (Cooke, Marcus, and Quester 1992, i) Self-selection is defined as individual sailors self-selecting into their second tour (i.e. reenlisting) according to their individual tastes. If an individual prefers sea duty and deploying, then he is more likely to reenlist.(Cooke, Marcus, and Quester 1992, i) The theory of job matching states that the better the job-person fit, the more likely the sailor will reenlist.(Cooke, Marcus, and Quester 1992, i) Both self-selection and job matching explain why those sailors who deploy less than eight months and those who have shorter time periods between deployments are more likely to reenlist. These individuals self-select their sea tours because they have a taste for life at sea and life deployed.

Beyond eight months, the effects of self-selection and job matching cannot compensate for the deprivations suffered during very long periods at sea. The standard deployment is six months in length. Most sailors accept this length, and anything beyond six months is considered non-standard. Those sailors who self-select because they enjoy sea life have learned to enjoy periods up to six months at sea. When faced with a deployment that exceeds the standard deployment length, these same sailors cannot be expected to maintain a high level of satisfaction with Navy life. Hence, very long deployments have a negative effect on reenlistment. Likewise, if a sailor wants to deploy but has to endure a long period between deployments, theoretically this sailor may decide that he is not longer satisfied with the Navy life and elect to separate.(Cooke, Marcus, and Quester 1992, i)

Hosek and Totten (2002) conducted a study of first-term enlistees in all services, at the request of the Department of Defense, in order to determine the effect of time away from home (deployed time) on the reenlistment decisions of military personnel.(Hosek and Totten 2002, i) The authors developed two probit regression models to evaluate the effects of deployments. The first model evaluated hostile and non-hostile deployments

independent of each other; while the second model evaluated the interaction between hostile and non-hostile deployments.(Hosek and Totten 2002, i)

Hosek and Totten (2002) used Defense Manpower Data Center PERSTEMPO data in order to determine a deployment episode. Family Separation Allowance was used to identify an individual as being deployed, and Imminent Danger Pay was used to identify a hostile deployment.(Hosek and Totten 2002, i) The study was limited to an evaluation of the three-year period preceding the reenlistment decision. The authors chose to ignore any deployments before this period because the majority of enlistees were four-year obligors who spend the first year in a training status from Recruit Training to A-School.(Hosek and Totten 2002, i) These individuals were followed to one year after EAOS in order to determine retention. For those individuals who extended, the study followed them for two years after EAOS. If the extenders remained in service for two years, they were considered to have been retained.(Hosek and Totten 2002, i)

The results of the first (non-interacted) probit model revealed that, for enlisted Marines, the first-term reenlistment probability increases with the number of non-hostile deployments and remains stable with increasing episodes of hostile deployments.(Hosek and Totten 2002, i) The interacted model showed that the likelihood of reenlisting increases as the number of deployments increase, whether hostile or non-hostile.(Hosek and Totten 2002, i)

Hosek and Totten (2002) explain this phenomenon with the theory of "self-selection." They hypothesize that members enter the military with naïve expectations about how much they will like deployment, the frequency and duration of deployment, and the variance of frequency and duration.(Hosek and Totten 2002, i) These expectations are updated through a learning process.(Hosek and Totten 2002, i) As the individual experiences a deployment, his views and expectations are modified. The more deployments an individual experiences, the more accurate the expectations become. This means that an individual is constantly refining his expectations and tastes with each deployment. Therefore, individuals with more deployments have a stronger taste for deployments and are more likely to remain in the military.

Fricker (2002) evaluated the effect of PERSTEMPO on officer retention for all services. Fricker defined retention as being on active duty one year following the completion of the initial service obligation.(Fricker 2002, iii) This definition is rather narrow because some officers remain in service more than a year beyond EAOS in order to better weigh their options; some of these individuals depart two or three years after EAOS.

Fricker (2002) evaluated how hostile and non-hostile deployments affect officer retention.(Fricker 2002, iii) He used Imminent Danger Pay and Family Separation Allowance from the DMDC PERSTEMPO file in order to determine deployment status.(Fricker 2002, iii) Imminent Danger Pay is an indicator of the individual being on a hostile deployment, whereas Family Separation Allowance indicates whether an individual is in a "deployed" status. Using Family Separation Allowance (FSA) alone is a questionable method to determine non-hostile deployments. This is because FSA only indicates that an individual has been away from home for greater than 30 days. Most officers do not consider themselves to be in a "deployed" status just because they are away from home for 31 days. This is because the general belief of Marines is that deployments last a minimum of 90-days. The 90-day minimum length coincides with the requirement for awarding of the Sea Service Deployment Ribbon. Marines use the Sea Service Deployment Ribbon as the generally accepted indicator that an individual has deployed. Unfortunately, the use of periods of less than 90 days as an indicator of deployment has been generally accepted for research purposes.

Separation is the dependent variable in Fricker's multivariate logistic regression model. The independent variables include one deployment, two deployments, three deployments, one hostile deployment, two hostile deployments, three hostile deployments, occupational field, gender, having dependents, being an Academy graduate, race, and dummy variables for the year of EAOS.(Fricker 2002, iii) This study did not investigate the effect of pay and unemployment rate on the decision to separate.

The Fricker (2002) study found that increasing the number of non-hostile deployments increases the likelihood of retention, while increasing the number of hostile deployments has no noticeable effect on retention.(Fricker 2002, iii) Fricker also

grouped the officers into separate occupational codes, one of which was "Pilot."(Fricker 2002, iii) The study revealed that a pilot with one non-hostile deployment is 46% less likely to separate than a pilot with no deployments.(Fricker 2002, iii) Results also revealed that pilots with one hostile deployment are 29.6% less likely to separate than pilots with no hostile deployments.(Fricker 2002, iii)

Overall, Fricker's (2002) results show that deployments in general increase retention among all officers, particularly pilots. The explanation given for this is the theory of "self-selection."(Fricker 2002, iii) This theory of "self-selection" indicates that officers who deploy the most frequently are volunteers. Those that do not deploy, or deploy less than other officers, do not wish to deploy. In addition, those officers who "self-select" to deploy also "self-select" to stay; these are the officers who are the most compatible with military service, while those who do not deploy are less compatible with military service, and as such and so more likely to separate.

Pierre (2005) conducted a more recent evaluation of the effect of deployment on enlisted retention. The subject of her study was the Navy's Hospital Corpsman specialty. The purpose of her study was to evaluate the effect of deployments on the Hospital Corpsman community since the beginning of the Global War on Terror.(Pierre 2005, i) The data consisted of two files of Hospital Corpsmen between the ranks of E-3 and E-6. The first data file contained data on all Hospital Corpsmen on active duty in 1998 who were eligible to reenlist prior to 11 September 2001. The second file contained data on all Hospital Corpsmen on active duty on 11 September 2001 who were eligible to reenlist prior to 31 March 2004.(Pierre 2005, i) Those sailors extending their enlistment but not reenlisting were ignored, and the study only looked at those who decided to reenlist or separate during each particular period.

The Pierre (2005) study attempted to identify a Global War on Terror effect for Hospital Corpsmen who were exposed to frequent deployments because of the war. The study modeled retention as predicted by gender, race, education, number of dependents, marital status, age at EAOS, duty type, deployment status, pay grade, and occupational field.(Pierre 2005, i) The results of the study revealed that being deployed increases the probability of reenlisting for both periods. (Pierre 2005, i)

The Pierre (2005) thesis used sailors on shore duty with no deployments as the control group from which to make comparisons for both samples. Both samples revealed that the probability of reenlisting is greater for those sailors who have deployed. Also, it appears that increasing the number of deployments has a positive effect on sailors' decisions to reenlist.(Pierre 2005, i)

The results of the Pierre thesis are consistent with previous studies addressing the relationship between OPTEMPO and retention. The Pierre thesis shows that increased OPTEMPO does have a positive effect on retention. The thesis also showed that Hospital Corpsmen exhibited similar relationships with respect to deployments in both time periods, 1998 and 2001. This showed that the observed effects of the GWOT on retention were not negative for Navy Hospital Corpsmen.

The available literature reveals some important relationships that are not intuitively understood. The average service member would argue that the likelihood of being retained in the service decreases for service members who are deployed more frequently. The literature, however, reveals that service members who deploy multiple times are more likely to stay in the military. The explanations given are those of "self-selection" and "job matching." These are good explanations during normal times. However, with the ongoing War on Terror, self-selection may no longer apply to the Marine Corps. Every Marine can expect to deploy multiple times prior to the end of his or her commitment. There is no longer an opportunity to "self-select" for deployments; deploying is even more of a way of life for Marines now.

Hosek, Kavanaugh, and Miller (2006) conducted the most recent analysis on the topic by evaluating the effect that deployments had on service members' retention decisions during the GWOT period. The authors acknowledged the previously mentioned Hosek and Totten (2002) RAND study does not accurately portray the relationship between deployments and retention in the Global War on Terror era.(Hosek, Kavanaugh, and Miller 2006,) This most recent study integrates the DMDC Status of Forces Surveys of Active Duty Personnel for March and July 2003 with focus groups conducted in the first six months of 2004. The focus groups included both enlisted and officers from each of the services and focused on "expectations of service life,

expectations of deployment, most valuable military experiences, unexpected challenges, deployment experiences, suggestions for improved preparation for service life and deployments, and reenlistment or career plans."(Hosek, Kavanaugh, and Miller 2006,) The DMDC surveys focused on stress and a service member's intent to stay in the military.(Hosek, Kavanaugh, and Miller 2006,) The primary results from this analysis include the sociological factors related deployment and their effects on retention behavior.

The authors conducted focus groups with both officer and enlisted personnel on bases with units that had returned from duty in either Afghanistan or Iraq.(Hosek, Kavanaugh, and Miller 2006,) The purpose of the focus groups was to identify sociological factors related to deployment, which could then be analyzed using logistic regression. The sociological factors identified were:

a. Pre-deployment stress which involves the amount of pre-deployment exercises required, and longer work hours as well as personal stress related to preparing family members for the separation.(Hosek, Kavanaugh, and Miller 2006, 37)

b. Longer and more frequent deployments.(Hosek, Kavanaugh, and Miller 2006, 38)

c. Increased work pace and longer work hours while deployed. (Hosek, Kavanaugh, and Miller 2006, 39)

d. Uncertainty before and during the deployment.(Hosek, Kavanaugh, and Miller 2006, 41)

e. Physical and environmental stressors involving conditions that service members must live in, as well as the physical danger expected as a result of being deployed to Afghanistan or Iraq.(Hosek, Kavanaugh, and Miller 2006, 40)

f. Family separation, and reintegration with family and community, which involves both the family members' concern for the deployed service member as well as the service member's concern for his or her family.(Hosek, Kavanaugh, and Miller 2006, 42)

Hosek, Kavanaugh, and Miller (2006) identify key sociological factors that contribute to the decision to stay or leave. These factors explain why deployment affects

retention rather than how deployments affect retention. This study lays the groundwork for future studies attempting to explain the effects of deployment on retention behavior in the GWOT period.

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III. DATA AND METHODOLOGY

A. DATA SOURCES AND LIMITATIONS

1. Data Sources

The data for this thesis come from three sources. The historical civilian airline industry hiring rate comes from Air, Inc.(Anonymous2006,) Data on individual Marines come from the Marine Corps' Total Force Data Warehouse (TFDW) and the Department of Defense Manpower Data Center (DMDC) PERSTEMPO file. The Marine Corps' Total Force Data Warehouse is the source for all demographic data on each individual Marine aviator. This data was merged with deployment data obtained from the DMDC PERSTEMPO file.

Due to limited historical data available from DMDC, this thesis evaluates a ten-year period from FY1995 through FY2005. This is further broken into two periods: pre-9/11 and post-9/11. The Pre-9/11 period contains FY1995 to FY2001, and the Post-9/11 (GWOT) period includes FY2002 to FY2005. The data are broken into these two periods based upon the attacks on the World Trade Center and the Pentagon on 11 September 2001. The timing of these attacks coincides with the end of FY2001, which is the end of the first data period (Pre-9/11). Immediately after the 9/11 attacks, the U.S. entered into a prolonged period of war that has been identified as the Global War on Terror. This thesis evaluates the retention decisions of Marine aviators who were eligible to separate in each of the periods identified by the study.

The data set consists of demographic information based on a snapshot at the time of each Marine aviator's Expiration of Active Obligated Service (EAOS). Therefore, demographic information is taken from the time that the Marine made his or her retention decision. The information was collected based on the characteristics at this time because these are the demographic factors most likely to influence the retention decision. The demographic data obtained through TFDW include age, race, gender, marital status, number of children, commissioning source, prior enlisted service, type of aviator, Weapons and Tactics Instructor MOS, and Forward Air Controller MOS. The data obtained from DMDC are deployment related and include the total number of

deployments, the number of non-hostile deployments, and the number of hostile deployments prior to making the retention decision.

2. Data Limitations

The data from the Marine Corps' TFDW are updated monthly and are considered by the Marine Corps to be highly accurate. TFDW contains the majority of the data needed for the thesis. In order to simplify, a snapshot was taken on 30 September for each fiscal year. This snapshot gives an indication of each individual Marine's demographic status at the end of the fiscal year.

The DMDC PERSTEMPO file uses Family Separation Allowance (FSA) and Imminent Danger Pay (IDP) to calculate a proxy for deployment status. FSA is only received after an individual is separated from his family for 30-days. IDP is received when an individual is in a combat zone. While IDP is a good indicator of a hostile deployment, FSA can be received on occasions that the Marine Corps does not consider to be deployments.

The standard deployment for Marines is the Marine Expeditionary Unit (Special Operations Capable (MEU (SOC)) deployment. This deployment consists of a six-month work-up period immediately followed by a six-month deployment. During the work-up period, a Marine may be away from home for as many as three months. This work-up period is not considered to be part of the deployment; the deployment does not begin until the ship pulls out of port and steams across the ocean.

While the majority of Marines deploy as part of the MEU (SOC), there are other ways to deploy such as the Unit Deployment Program (UDP) to Japan and deployments in support of contingency operations. Most Marines consider a deployment to be one that is outside of the continental United States (OCONUS) and for a minimum duration of 90-days. The 90-day duration is considered the minimum because this is the number of days required in order to receive the Sea Service Deployment Ribbon. This ribbon serves as an indicator of deployed service for the Marine Corps.

Based on the standard MEU (SOC) deployment as well as the duration requirement for the Sea Service Deployment Ribbon, the PERSTEMPO data received

from DMDC had to be modified in order to be useful in studying Marine Corps deployments. All deployments of duration less than 90-days (3 months) were censored, unless the individual received IDP. If an individual received IDP, then this is an indication that he was OCONUS and deployed to a combat zone. In order to account for possible accounting errors, this study considers two consecutive months in receipt of IDP as one episode of deployment.

B. DEPENDENT AND EXPLANATORY VARIABLES

1. Description of the Marine Corps Aviator Demographics

Table 3.1 provides a description of Marine Corps aviators in the data set as Pooled data, Pre-9/11 data, and Post-9/11 (GWOT) data. The frequency distributions and descriptive statistics give insight into changes in the characteristics of Marine Corps aviators over the time period from FY1995 to FY2005.

An analysis of the Pre-9/11 and GWOT groups indicates significant differences in Marine Corps aviators' demographics between the two periods; these differences are annotated in Table 3.1. The most significant difference between the two groups is the retention rate. Retention for the GWOT period was 65.96% while the Pre-9/11 period saw a retention rate of 97.19%. The Chi-Square statistic for the association of retention and time period is statistically significant at the .01 level.

The GWOT period group consists of significantly more minorities (5.61%) and females (2.51%) than the Pre-9/11 period (3.14% minorities and no females). The GWOT period aviators are older and more likely to be Service Academy graduates than ROTC graduates compared to the Pre-9/11 period. Finally, the GWOT period consists of significantly more Fixed-Wing Pilots (40.05%) and fewer Rotary-Wing Pilots (49.63%) than the Pre-9/11 period, 34.36% and 54.8%, respectively.

Table 3.1.   Characteristics of Marine Corps Aviators by Time Period

Characteristic	1995-2005 (N=2,443)	Pre-9/11 (N=1,531)	GWOT (Post-9/11) (N=1,231)
RETAINED***	**83.27%**	**97.19%**	**65.96%**
PERSONAL CHARACTERISTICS			
Race***			
White	92.29%	93.53%	90.74%
Minority	4.24%	3.14%	5.61%
Gender***			
Male	98.89%	100%	97.48%
Female	1.12%	0.0%	2.51%
Dependents			
Single no children	18.83%	18.93%	18.75%
Single with children	15.93%	1.22%	1.89%
Married with children	53.69%	53.70%	53.69%
Married no children	18.83%	18.93%	18.75%
Age (mean, in years)[+++]	32.49	31.90	32.23
MILITARY SERVICE CHARACTERISTICS			
Source of Commission***			
Academy	13.65%	10.52%	17.55%
ROTC	13.03%	14.76%	10.89%
OCS	70.92%	70.74%	71.16%
Type of Aviator***			
Fixed Wing Pilot	36.89%	34.36%	40.05%
Rotary Wing Pilot	52.50%	54.80%	49.63%
Naval Flight Officer	10.60%	10.84%	10.32%
Prior Enlisted	4.30%	4.44%	4.14%
Weapons and Tactics Instructor***	17.16%	18.55%	15.43%
Forward Air Controller	9.56%	9.01%	10.24%
Present Value of ACP (mean, in $) [+++]	$40,976	$30,669	$53,796
CIVILIAN ECONOMIC CONDITIONS			
Airline Hires (mean, in number of pilots) [+++]	3,880	4,490	3,120

SOURCE: Author

*** ChiSq statistic significant at the .01 level	+++ T-statistic significant at the .01 level
** ChiSq statistic significant at the .05 level	++ T-statistic significant at the .05 level
* ChiSq statistic significant at the .10 level	+ T-statistic significant at the .10 level

2.   Description of Marine Corps Aviator Deployment Distribution

Analyzing the distribution of deployments in the Pooled, Pre-9/11, and GWOT samples provides significant explanatory information. As shown in Table 3.2, nearly twice as many aviators from the GWOT group have more than two deployments as compared to aviators from the Pre-9/11 group. Nearly 31% of the aviators in the GWOT group have more than two deployments, while only 18.6% of the Pre-9/11 group have more than two deployments. Table 3.2 also shows that fewer aviators from the GWOT

group have less than two deployments than those in the Pre-9/11 group (69.4% and 81.4%, respectively). A Chi-Square test indicates that the differences in the number of deployments between the two groups are statistically significant. This is most likely attributable to the increased OPTEMPO created by the GWOT. It is more likely that aviators in the GWOT group will deploy three or more times during the first Fleet Marine Force (FMF) tour. This is a result of the current deployment cycle that exists in the FMF with seven months deployed followed by seven months home.

Tables 3.3 and 3.4 provide cross-tabulations of deployments separately for the Pre-9/11 and GWOT groups. This comparison shows that there are more Pre-9/11 Marine aviators with no deployments (15.1%) or only one deployment (28.7%) than GWOT aviators with similar numbers of deployments (10.6% and 23.3%, respectively). These tables also reinforce the conclusions from Table 3.2; nearly twice as many aviators from the GWOT group have more than two deployments than those in the Pre-9/11 group (30.5% and 17.5%, respectively). These distributions strongly support the expectation that the increased OPTEMPO from the GWOT has in fact increased the number of deployments for Marine aviators. This is shown in the smaller number of aviators who have not deployed, as well as the greater number of aviators who have more than two deployments in the GWOT group. This group has endured a deployment cycle of seven months deployed and seven months home. This has increased the OPTEMPO, which in turn has increased the opportunities for deployments prior to being eligible to separate.

Table 3.2.   Distribution of Total Deployments (1995-2005)

Number of Deployments	Pre-9/11 Sample (1995-2001)	GWOT Sample (2002-2005)	Pooled Sample (1995-2005)
0	204 *(15.1%)*	116 *(10.6%)*	320 *(13.1%)*
1	387 *(28.6%)*	255 *(23.4%)*	642 *(26.3%)*
2	509 *(37.7%)*	387 *(35.4%)*	896 *(36.7%)*
>2	251 *(18.6%)*	334 *(30.6%)*	585 *(23.9%)*
Total	1,351 *(100%)*	1,092 *(100%)*	2,443 *(100%)*

SOURCE: Author

Table 3.3.   Distribution of Hostile and Non-Hostile Deployments (Pre-9/11 Group, 1995-2001)

Non-Hostile	Hostile				
	0	1	2	>2	Total
0	204 *(15.1%)*	229 *(17.0%)*	192 *(14.2%)*	60 *(4.4%)*	685 *(50.7%)*
1	158 *(11.7%)*	186 *(13.8%)*	63 *(4.7%)*	24 *(1.8%)*	431 *(31.9%)*
2	131 *(9.7%)*	53 *(3.9%)*	15 *(1.1%)*	2 *(0.1%)*	201 *(14.9%)*
>2	27 *(2.0%)*	5 *(0.4%)*	2 *(0.1%)*	0 *(0.0%)*	34 *(2.5%)*
Total	520 *(38.5%)*	473 *(35.0%)*	272 *(20.1%)*	86 *(6.4%)*	1,351 *(100%)*

SOURCE: Author

Table 3.4.   Distribution of Hostile and Non-Hostile Deployments (GWOT Group, 2002-2005)

Non-Hostile	Hostile				
	0	1	2	>2	Total
0	116 *(10.6%)*	184 *(16.8%)*	220 *(20.1%)*	115 *(10.5%)*	635 *(58.2%)*
1	71 *(6.5%)*	117 *(10.7%)*	91 *(8.3%)*	44 *(4.0%)*	323 *(29.6%)*
2	50 *(4.6%)*	37 *(3.4%)*	15 *(1.4%)*	11 *(1.0%)*	113 *(10.3%)*
>2	12 *(1.1%)*	5 *(0.5%)*	3 *(0.3%)*	1 *(0.0%)*	21 *(1.9%)*
Total	249 *(22.8%)*	343 *(31.4%)*	329 *(30.1%)*	171 *(15.7%)*	1092 *(100%)*

SOURCE: Author

C.   METHODOLOGY

1.   Theoretical Model

Multiple regression analysis is a valuable tool in explaining retention decisions. The logistic regression model is appropriate for the analysis of retention because the dependent variable "*retain*" is binary with a value equal to one for those staying and a value equal to zero for those who separate. The theoretical model is:

$$L_i = \ln [P_i/(1-P_i)] = \alpha + \beta x_i$$

where:

L_i = log of the odds ratio

P_i = probability that an individual stays, given the personal attributes

in X_i (vector of explanatory variables)

α = intercept parameter

β = vector of slope parameters

2.   Multivariate Logistic Regression Models

Three multivariate logistic regression models are utilized in this study. Each of these regression models is run for three separate samples: a Pooled Sample, the Pre-9/11 Sample, and the GWOT Sample. The first model is the Total Deployment Model that evaluates the effects of deployments, both hostile and non-hostile, on the retention decision of aviators in each of the three groups. The deployment variables used are *D0* (zero deployments), *D1* (one deployment), *D2* (two deployments), and *D3* (more than two deployments). The second model evaluates the effects of non-hostile and hostile deployments independently.   The deployment variables are *N0* (zero non-hostile deployments), *N1* (one non-hostile deployment), *N23* (multiple non-hostile deployments), *H0* (zero hostile deployments), *H1* (one hostile deployment) and *H23* (multiple hostile deployments). The third model evaluates the interaction between non-hostile and hostile deployments. The deployment variables for this model are *N0H0* (zero deployments), *N0H* (zero non-hostile and at least one hostile deployment), *N1H0* (one non-hostile and zero hostile deployments), *N1H1* (one non-hostile and one hostile deployments), *N23H0*

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(multiple non-hostile and zero hostile deployments), and *N23H* (multiple non-hostile and at least one hostile deployments).

a. Total Deployment Regression Model

The Total Deployment empirical model used to find predicted probabilities of retention for Marine Corps aviators is:

$$\ln[P_i/(1-P_i)] = \beta_0 + \beta_1(age) + \beta_2(minority) + \beta_3(female) + + \beta_4(ROTC) + \beta_5(OCS) + \beta_6(Prior\ Enlisted) + \beta_7(RWP) + \beta_8(NFO) + \beta_9(WTI) + \beta_{10}(FAC) + \beta_{11}(PV\ ACP) + \beta_{12}(Hires) + \beta_{13}(MWC) + \beta_{14}(MNC) + \beta_{15}(SWC) + \beta_{16}(D1) + \beta_{17}(D2) + \beta_{18}(D3) + \beta_{19}(N) + \beta_{20}(Hostile) + \beta_{21}(GWOT)$$

b. Non Interacted Deployment Regression Model

The Non-Interacted Deployment model evaluates the effect of non-hostile and hostile deployments independently (not interacted with each other). The Non-Interacted Deployment empirical model used to find predicted probabilities of retention for Marine Corps aviators is:

$$\ln[P_i/(1-P_i)] = \beta_0 + \beta_1(age) + \beta_2(minority) + \beta_3(female) + \beta_4(ROTC) + \beta_5(OCS) + \beta_6(Prior\ Enlisted) + \beta_7(RWP) + \beta_8(NFO) + \beta_9(WTI) + \beta_{10}(FAC) + \beta_{11}(PV\ ACP) + \beta_{12}(Hires) + \beta_{13}(MWC) + \beta_{14}(MNC) + \beta_{15}(SWC) + \beta_{16}(N1) + \beta_{17}(N23) + \beta_{18}(H1) + \beta_{19}(H23) + \beta_{20}(GWOT)$$

c. Interacted Deployment Regression Model

The Interacted Deployment Model evaluates the effects of interactions between non-hostile and hostile deployments on the retention decision. The Interacted Deployment empirical model used to predict probabilities for first-term Marine Corps aviators is:

$$\ln[P_i/(1-P_i)] = \beta_0 + \beta_1(age) + \beta_2(minority) + \beta_3(female) + \beta_4(ROTC) + \beta_5(OCS) + \beta_6(Prior\ Enlisted) + \beta_7(RWP) + \beta_8(NFO) + \beta_9(WTI) + \beta_{10}(FAC) + \beta_{11}(PV\ ACP) + \beta_{12}(Hires) + \beta_{13}(MWC) + \beta_{14}(MNC) + \beta_{15}(SWC) + \beta_{16}(N0H) + \beta_{17}(N1H0) + \beta_{18}(N1H) + \beta_{19}(N23H0) + \beta_{20}(N23H) + \beta_{21}(GWOT)$$

IV.   RETENTION MODEL

A.   DEFINING RETENTION

Retention and the turnover of the officer corps of any armed force is always a concern. Studies have generally focused on the retention of individuals. Previous retention studies often define retention as "surviving" two years beyond the end of his or her initial service obligation. This study evaluates the retention decisions of Marine aviators between fiscal years 1995 through 2005. If the standard two-year survival period were used, this study would need to be adjusted to include only those aviators whose initial service commitment ended in fiscal year 2003. This would omit those Marine aviators whose Expiration of Active Obligated Service (EAOS) occurred in fiscal years 2004 and 2005. The latter individuals are likely to be more affected by the Global War on Terror than any previous fiscal year cohort. In order to include these two cohorts, this study will modify the survival definition for retention. For the purpose of this study, retention is defined as surviving at least six months after the Expiration of Active Obligated Service. This will allow an evaluation of the retention behavior of GWOT-period aviators.

This study will evaluate the retention decisions of aviators whose active obligated service expired between October 1994 and June 2005. This window is further divided into two periods separated by the attacks on the World Trade Center and Pentagon on September 11, 2001 (9/11). The pre-9/11 sample consists of those aviators who made a retention decision between October 1994 and September 2001. The post-9/11 sample consists of those aviators who made the retention decision between October 2001 and June 2005. Separating this population into two samples is supported by a Log Likelihood Test. A Log Likelihood test was conducted in order to determine if a significant difference exists between these two samples. The results of the test reveal that the samples are significantly different and must be evaluated separately.

## B.	FACTORS ASSOCIATED WITH RETENTION

### 1.	Personal Characteristics

#### a.	*Age at EAOS*

Labor economic theory states, "the quality of job matches should rise with age."(Ehrenberg and Smith 2003, 587) Job matching is important since it is a primary factor in an individual's decision to remain with his current employer or to seek other employment. As the individual gains more experience, he learns more about his employer and what is expected of him. A younger individual has less experience and is learning more about employers and about his expectations with respect to an employment situation.(Ehrenberg and Smith 2003, 587) As an individual gets older, he has a better idea of what he expects with respect to employment.

Because of the labor economic theory that job matching improves with age, it is expected that as an aviator gets older, he is gaining experience. He is learning about the Marine Corps and learning about his own wants and expectations. He is learning whether or not he is compatible with the Marine Corps and if he wants to remain in the Corps.

A Marine aviator does not have the option of quitting his job whenever he wants, as the average civilian employee does. The Marine can only resign upon completion of his obligation; therefore, age must be evaluated at the time of EAOS. This is when the Marine can first make the decision to retain or separate. Therefore, based upon labor economic theory, it is expected that the older the Marine aviator is at EAOS, the more likely he will remain in the service.

#### b.	*Race*

Differences in race can be the basis for discrimination in the labor market. The study of labor economics reveals that market discrimination may exist based upon race. Three general theories for market discrimination are discussed in Ehrenberg (2003). These include personal prejudice, statistical prejudgment, and the presence of noncompetitive forces in the labor market.(Ehrenberg and Smith 2003, 587)

These theories of labor market discrimination explain the wage and employment discrimination that exists in the marketplace. The idea of personal prejudice

lies in the fact that some "employers, fellow employees, or customers dislike associating with workers of a given race."(Ehrenberg and Smith 2003, 587) Statistical prejudgment exists when "employers project onto individuals certain perceived group characteristics."(Ehrenberg and Smith 2003, 587) And, lastly, labor economic theory states that noncompetitive forces are present in the labor market which result in discrimination based upon one's race.(Ehrenberg and Smith 2003, 587)

These theories hypothesize about the causes of discrimination in the civilian labor market. It can be argued that this same discrimination exists in the military, but not to the extent that it does in the civilian labor market. The military has a very special need for the most qualified individual regardless of race. Therefore, the military has been able, for the most part, to overcome the issue of discrimination. Although, it must be noted that the military is not a perfect organization, and some forms of discrimination may exist, but they are likely to be on a much smaller scale than in the civilian labor market.(Tice 2000, 12)

Because of the general inequity in the civilian labor market, the options for civilian careers for minorities are more limited than options available to the majority. This is expected to lead more minorities to remain in the military beyond EAOS than individuals in the majority group. Minorities may find better options for advancement and success in the military due to the military's promotion system which is based upon the promoting best qualified individual.

c.   Gender

The labor economic theory concerning gender is similar to that of race. A wage earnings gap is known to exist between men and women. In the mid-1990s, the average weekly earnings of women were 76% of the earnings of men.(Ehrenberg and Smith 2003, 587), indicating that women may be discriminated against in the civilian marketplace.   In the military, women receive the same earnings as their male counterparts. Wage discrimination, at least, does not exist in the military.

While wage discrimination does not exist in the military, other forms of gender bias do exist. The military has historically been male dominated, with women as a small minority. Presently women are not permitted to serve in combat arms specialties

and discussion abounds in Congress, and elsewhere, as to women's role in combat. Because of these limitations, it is expected that women will be less likely than men to remain in the service beyond expiration of their obligated service contracts.

d. Marital Status and Dependents at EAOS

Marital status and dependents will have an impact on an individual's employment decision. Individuals who are married with children (*MWC*) or single with children (*SWC*) will have a stronger desire for stable employment situations than those who are single with no children due to the need and desire to support a family. The Marine Corps provides a stable earnings flow, a stable future (with respect to employment) and an attractive retirement plan. Thus, Marine Corps aviators are more likely to remain in the military if they are married or have children.

2. Military Service Characteristics

a. Commissioning Source

Many commissioning sources exist for Marine Corps officers, from direct commissioning programs to enlisted commissioning programs. The Marine Corps commissions officers through seven programs: Service Academies, Naval Reserve Officer Training Corps (NROTC), Platoon Leader's Course (PLC), Officer Candidate Course (OCC), Marine Enlisted Commissioning Program (MECEP), Enlisted Commissioning Program (ECP), and Meritorious Commissioning Program (MCP).

These programs are generally divided into direct commissioning programs and enlisted commissioning programs. However, some prior enlisted Marines do attend the direct commissioning programs. The direct commissioning programs are the Service Academies, NROTC, PLC, and OCC. These programs are available to individuals with no military background. The Service Academies and NROTC are college scholarship programs available to individuals entering college directly from high school. PLC is a non-scholarship program offered to college students who decide to enter the Marine Corps while already enrolled in college. OCC is a non-scholarship program available to college graduates who decide that they want to become Marine Corps officers. The Service Academies and NROTC are funded by the Navy and Marine Corps and accept a small number of prior enlisted personnel each year.

The enlisted commissioning programs are MECEP, ECP, and MCP. MECEP is a scholarship program offered to enlisted Marines. This program allows enlisted Marines to attend college full-time while continuing to serve on Active Duty in the Marine Corps. These enlisted Marines attend Officer Candidate School upon graduation and are commissioned as Second Lieutenants in the Marine Corps. ECP is designed for enlisted Marines already in possession of a college degree. This program selects enlisted Marines to attend OCS and receive a commission as a Marine officer. The MCP program is designed for exceptional enlisted Marines not in possession of a college education. These individuals are sent to OCS and receive their commissions; they then carry with them the obligation to obtain a college education through night school while on active duty.

Each of these programs attracts different people. The enlisted commissioning programs attract those individuals who have already shown a strong desire to serve and remain in the service. This group of Prior Enlisted Marines also has already invested a great deal of time into the Marine Corps. Therefore, this group is the most likely to remain in the Marine Corps for a twenty-year career.

The direct commissioning programs attract different types of personnel. The Service Academies and NROTC attract individuals who have a strong desire to serve at a younger age than the other direct commissioning programs. These individuals enter into the programs with higher expectations placed upon them by the Marine Corps than other directly commissioned officers due to the investment made by the service. Academy and NROTC graduates are the most expensive for the Marine Corps to recruit and train. The PLC and OCC programs attract individuals who may have a high desire for service, but also who may be looking for a "jump start" on their careers. These individuals are college graduates who have not determined the course of their future; they see military service as an opportunity to gain experience and prepare themselves for careers in the civilian workforce. These individuals will be less likely to remain in the military than Service Academy and NROTC graduates will.

b. *Prior Enlisted Service*

The labor economic theory of job matching applies to prior enlisted service Marines. These individuals are generally older than their counterparts and have previous experience in the Marine Corps. They have already displayed an affinity for the Marine Corps lifestyle. Likewise, by selecting these individuals for enlisted commissioning programs, the Marine Corps has indicated that it is pleased with their performance and wants to continue their employment.

The theory of job matching, suggests that prior enlisted Marines have identified themselves and been identified by the Marine Corps to be a good match for Marine Corps life. Because of this, prior enlisted Marines are expected to be more likely to remain in the military for a career than non-prior enlisted Marine officers.

c. *ACP Amount Offered at EAOS*

The amount of ACP offered to aviators depends on the specific aircraft flown. Table 4.1 shows the numeric MOS and a description of the corresponding type of aviator. Table 4.2 shows that ACP has undergone many changes during the period covered by this study in terms of which MOS' were offered ACP. During FY1995, only F/A-18 Hornet pilots were offered ACP. During FY1996, helicopter pilots as well as EA-6B Prowler pilots were excluded from receiving ACP. FY1997 was an odd year, with KC-130 Hercules pilots and UH-1 helicopter pilots receiving ACP. During FY1998 and FY1999, all aviators were offered ACP with the exception of EA-6B pilots. Finally, from FY2000 to date, all Marine Corps aviators have been offered ACP.

The Marine Corps offers ACP to pilots as a retention incentive. The amount of ACP offered has changed due to the overages or shortages observed in each aviation community. From FY1995 through FY1997, the Marine Corps identified few shortages among aviators. However, since then, all aviation MOS's have been identified as "critical MOS's", and as such, are offered ACP in order to counter existing shortages.

The amount of ACP has been determined based upon the number of aviators needed. By observing the amounts offered it appears that fixed-wing pilots have suffered shortages since the beginning of the ACP program. Rotary wing pilots and naval flight officers have not been considered as critical as fixed wing pilots. However,

this changed in FY2005, with rotary wing pilots being offered the same ACP amounts as fixed-wing pilots. It would appear, by observing ACP alone, that the Marine Corps currently is suffering from shortages of all pilots.

It is expected that as the dollar amount of ACP offered increases, the number of aviators who will accept ACP and agree to extend will also increase. Therefore, by increasing the amount of ACP offered in FY 2005 to helicopter pilots the Marine Corps appears to recognize that the GWOT has had a negative effect on retention.

Table 4.1   USMC Aviation Military Occupational Specialties (MOS)

MOS	Description
7509	AV-8 Harrier Pilot
7523	F/A-18 Hornet Pilot
7525	F/A-18 Hornet Weapon System Operator (WSO)
7531/2	MV-22 Osprey Pilot
7543	EA-6B Prowler Pilot
7556/7	KC-130 Hercules Pilot
7562	CH-46 Sea Knight Pilot
7563	UH-1 Huey Pilot
7564	CH-53D Sea Stallion Pilot
7565	AH-1 Cobra Pilot
7566	CH-53E Sea Stallion Pilot
7588	EA-6B Prowler Electronic Countermeasures Officer (ECMO)

SOURCE: USMC MOS Manual

Table 4.2   FY 1995-2005 Aviation Continuation Pay (ACP)

FY	Critical MOS's	Additional Service Obligation	Bonus Amount Offered
1995	7523	2 Years	$6,000/yr
1996	7509 7523 7525 7556/7	2 Years	$6,000/yr
1997	7556/7 7563	Through 14 YCS	$12,000/yr
1998	7509 7523 7525 7556/7 7562 7563 7564 7565 7566 7588	Through 14 YCS	$12,000/yr

1999	7509 7523 7525 7556/7 7562 7563 7564 7565 7566 7588	Through 14 YCS	$12,000/yr
2000	7509 7523 7525 7532 7543 7556/7 7562 7563 7564 7565 7566 7588	Short Term: 3 Years Long Term: Through 16 YCS	Short Term: FW Pilots - $18,000/yr RW Pilots - $9,000/yr NFOs - $6,000/yr Long Term: FW Pilots - $25,000/yr RW Pilots - $12,000/yr NFOs - $12,000/yr
2001	7509 7523 7525 7532 7543 7556/7 7562 7563 7564 7565 7566 7588	Short Term: 3 Years Long Term: Through 16 YCS	Short Term: FW Pilots - $18,000/yr RW Pilots - $9,000/yr NFOs - $6,000/yr Long Term: FW Pilots - $25,000/yr RW Pilots - $12,000/yr NFOs - $12,000/yr

2002	7509 7523 7525 7532 7543 7556/7 7562 7563 7564 7565 7566 7588	Short Term: 3 Years Long Term: Through 16 YCS	Short Term: FW Pilots - $18,000/yr RW Pilots - $9,000/yr NFOs - $6,000/yr Long Term: FW Pilots - $25,000/yr RW Pilots - $12,000/yr NFOs - $12,000/yr
2003	7509 7523 7525 7532 7543 7556/7 7562 7563 7564 7565 7566 7588	Short Term: 3 Years Long Term: Through 16 YCS	Short Term: FW Pilots - $18,000/yr RW Pilots - $6,000/yr NFOs - $6,000/yr Long Term: FW Pilots - $25,000/yr RW Pilots - $12,000/yr NFOs - $12,000/yr
2004	7509 7523 7525 7532 7543 7556/7 7562 7563 7564 7565 7566 7588	Short Term: 3 Years Long Term: Through 16 YCS	Short Term: FW Pilots - $18,000/yr RW Pilots - $3,000/yr NFOs - $3,000/yr Long Term: FW Pilots - $25,000/yr RW Pilots - $7,000/yr NFOs - $7,000/yr

		Short Term: 3 Years	Short Term:
2005	7509 7523 7525 7532 7543 7556/7 7562 7563 7564 7565 7566 7588	Short Term: 3 Years Long Term: Through 16 YCS	Short Term: FW Pilots - $18,000/yr RW Pilots - $3,000/yr NFOs - $3,000/yr Long Term: FW Pilots - $25,000/yr RW Pilots - $7,000/yr NFOs - $7,000/yr
2006	7509 7523 7525 7532 7543 7556/7 7562 7563 7564 7565 7566 7588	Short Term: 3 Years Long Term: Through 16 YCS	Short Term: FW Pilots - $10,000/yr RW Pilots - $10,000/yr NFOs - $3,000/yr Long Term: FW Pilots - $18,000/yr RW Pilots - $18,000/yr NFOs - $7,000/yr

SOURCE: CMC MPP

d.   *Type of Aviator*

The different aviation communities have different options in the civilian sector. Naval Flight Officers have fewer options for civilian employment than do pilots. Fixed-wing pilots have many more options than helicopter pilots. Fixed-wing pilots are enticed away from the military by increased earnings and an improved quality of life offered by civilian airlines. Helicopter pilots do not have the same options and are not qualified to fly for the major civilian airlines. Employment opportunities do exist for helicopter pilots in the civilian market, but these jobs do not offer the same earnings potential and benefits as the jobs available to fixed-wing pilots.

Because of the difference in civilian opportunities between the different types of aircraft, each community is likely to have a unique retention pattern. Prior to the

GWOT, jet pilots have had the highest probability of separating from the service. However, after the 9/11 attacks, the civilian airline industry's hiring rates have fallen. The peak of the civilian airline industry occurred in 2000 with over 18,000 pilots hired and less than 600 pilots on furlough. During the following year, 2001, the airlines hired over 12,000 pilots and furloughed over 6,000. The vast majority of the 2001 furloughs occurred immediately after the 9/11 attacks. Since 2001, the airlines have hired fewer pilots and have increased the number of pilots on furlough. The low year for the airline industry came in 2003 with approximately 4,000 new hires while furloughing nearly 10,000 pilots.(Anonymous2006,) Because of the reduction in aviator employment, jet pilots have fewer opportunities in the civilian market. Helicopter pilots have always had few opportunities in the civilian market; however, the helicopter industry has not changed since the 9/11 attacks.(Anonymous2006,) Finally, the naval flight officer community has always had the fewest opportunities in the civilian market. These aviators are simply not in as much demand for their aviation skills as pilots. Therefore, naval flight officers are expected to be less likely than pilots to separate from the Marine Corps. Fixed Wing pilots are expected to be more likely to separate from the Marine Corps than are helicopter pilots.

e.   *Weapons and Tactics Instructor (WTI) MOS*

Few Marine aviators are chosen to attend the Marine Corps's Weapons and Tactics Instructor course. Each year, only two classes are held with less than 120 aviators attending each year. These aviators are chosen to be the Weapons and Tactics Instructors (WTIs) for their respective squadrons. This WTI billet is highly coveted among aviators. Because of the nature of the billet, as well as the desire of aviators to receive this training, those aviators that are selected are generally considered "the cream of the crop." Because of the status identified with graduation from the WTI Course, it is expected that these aviators are more likely to remain in the Marine Corps beyond EAOS.

f.   *Forward Air Controller (FAC) MOS*

Each Marine Corps infantry battalion is manned with three aviators as Forward Air Controllers (FACs). This billet as a FAC has ambiguous connotations attached to it for aviators. Some aviators view any billet outside of the squadron, such as the FAC billet, as not being career enhancing and are disgruntled when assigned to them.

Other aviators have a strong desire to serve with ground units as a FAC. Because of the ambiguity, it is difficult to determine how FAC tours will affect retention.

g. *Number of Deployments at EAOS*

The number of deployments is identified by the DMDC PERSTEMPO file. This file identifies as time deployed any day that a Marine was not physically at his home station, with the exception of time spent temporarily assigned to schools. The use of this data in its original form does not give an accurate account of Marine Corps deployments. Marines do not consider time spent in the United States as a deployment, but these detachments are included in the PERSTEMPO file. Only time spent overseas for 90 days or greater is generally accepted as a deployment by most Marines. The minimum length for a deployment is considered to be 90-days because this amount of time is needed to qualify for a Sea Service Deployment Ribbon, which is the primary indicator of having deployed. In addition, it should be noted that the standard for a Marine Corps deployment is a MEU(SOC) deployment aboard ship, which lasts a minimum of six months. Based on this definition of deployment, this study will only include and evaluate those deployments outside of the U.S. for periods of 90-days or greater.

Marines would argue that the more frequently a Marine is deployed, the more likely it is that the Marine would separate at the end of his obligation. This is because of the perceived hardship of being deployed and being separated from family. However, several studies have indicated that this may not be true. These studies have revealed that Marines who deploy frequently are also the ones most likely to remain in the Corps. The primary reason given for this is a selection bias inherent in the system. The studies point to self-selection and Commander selection as the reasons for this phenomena.(Hosek and Totten 2002, i)

The concept of self-selection indicates that those who are deploying the most frequently are the Marines who want to deploy. This explanation goes hand-in-hand with the theory of job matching.(Ehrenberg and Smith 2003, 587) These Marines are self-selecting to deploy because they enjoy deployments, which is a result of their satisfaction with Marine Corps life and life deployed.

The concept of Commander Selection is that the Unit Commander who is about to deploy, selects the best officers available. The Commander wants to be successful and, therefore, wants to surround himself with only the best. He would not order an officer to deploy if that officer did not want to do so. Those officers who are selected to deploy are selected partially because of their desire to deploy. This theory also is consistent with the theory of job matching, in that those officers who are selected are the ones who are the most compatible with the Marine Corps and have displayed strong performance records.

Using the theories of self-selection, Commander selection, and job matching, it is likely that those individuals who deploy the most frequently will be the most likely to be retained. Likewise, those who have the fewest deployments will be the most likely to separate.

3.   Civilian Economic Conditions

The state of the economy has a major impact on a Marine's decision to remain in the Corps. If the economy is strong, then there will be many opportunities available in the civilian labor market. If the economy is weak, then these opportunities will not be as readily available. In order for a Marine aviator to be enticed into the civilian market, a better employment option must be available.

a.   *Commercial Airline Industry*

The commercial airline industry is a significant factor in the aviator's retention decision. The commercial airline industry offers what is perceived as a better lifestyle with better compensation and benefits. Because of this, the airline industry appeals to many military pilots. The peak of the civilian airline industry occurred in 2000 with over 18,000 pilots hired and less than 600 pilots on furlough. The following year began a decline in pilots being hired and a corresponding increase in the number of pilots being furloughed. Since 2001, the airlines have hired fewer pilots and have increased the number of pilots on furlough.(Anonymous2006,) Because of the reduction in civilian aviation employment, pilots have fewer opportunities in the civilian market. However, the limited opportunities available for pilots remain enticing to military pilots. The number of pilots hired by the airline industry will most likely affect the decision of

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Marine aviators to stay or leave the service. As the number of pilots hired by the commercial airline industry increases, the number of Marine aviators who separate will most likely also increase.

4. Global War on Terror

Wartime is both the most difficult and most rewarding time for service members. During wartime, service members suffer through long and frequent deployments. However, these individuals are performing the jobs that they entered the service and were trained to perform. Everyone enters the military with an understanding that he or she may be called upon to participate in armed conflict.

Marines are a special breed. Marines distinguish themselves from the other services with their esprit de corps and will to fight. Individuals enter into the Corps with the belief that the United States Marine Corps is the finest fighting force in the world. They also have an understanding of the history and legacy of the Marine Corps and hope to uphold that history and legacy. Marines are expected to want the opportunity to prove themselves in combat. Therefore, the Marine Corps, perhaps more so than any other service, is strongest during times of war. Because of the nature of the Marine Corps, it would be expected that those Marines who have experienced combat will be more likely to be retained than those who have never seen combat.

While Marines are proud to serve and fight this nation's battles, there is a limit to the deprivation they, or their families, can withstand. The Global War on Terror is a prolonged war that has no end in sight. Marines are deploying more frequently than at any other time in the last twenty years. The increased OPTEMPO and PERSTEMPO coupled with the indefinite period of the GWOT have worn on many Marines. The same Marines who hunger for battle are now weary from two, three, or more combat tours in Iraq or Afghanistan. Because of potential exhaustion, it is expected that Marines who have served in the GWOT will be more likely to separate. It is hypothesized that individuals with the most GWOT deployments will be the most likely to separate.

C. SUMMARY

This study evaluates the retention decisions of Marine Corps aviators between October 1994 and June 2005. It observes the "survival" of these aviators six months

beyond their Expiration of Obligated Service (EAOS) date. This six-month survival period allows for standardization across the entire period and also allows for an evaluation of the current retention decisions of Marine aviators. A Marine aviator's retention decision is evaluated based upon variables related to personal characteristics, military service characteristics, civilian economic conditions, and the Global War on Terror. Table 4.3 shows the expected relationship between each independent variable and the dependent variable, retention.

Table 4.3   Explanatory Variables and Expected Effects on Retention

Variable	Variable Type	Expected Sign
Age at EAOS	Continuous	Positive
White	Binary	Base
Minority	Binary	Positive
Male	Binary	Base Case
Female	Binary	Negative
Single with no children (*SNC*)	Binary	Base Case
Single with children (*SWC*)	Binary	Negative
Married with no children (*MNC*)	Binary	Negative
Married with Children (*MWC*)	Binary	Negative
Service Academy	Binary	Base Case
Officer Candidate School (*OCS*)	Binary	Positive
ROTC	Binary	Positive
Prior Enlisted Service	Binary	Positive
Present Value of ACP (*PV thou*)	Continuous	Positive
Fixed-Wing Pilot (*FWP*)	Binary	Base Case
Rotary-Wing Pilot (*RWP*)	Binary	Negative
Naval Flight Officer (*NFO*)	Binary	Negative
Weapons and Tactics Instructor (*WTI*)	Binary	Positive
Forward Air Controller (*FAC*)	Binary	Unknown
Airline Hires (*Hires thou*)	Continuous	Negative
Zero Deployments (*D0*)	Binary	Base Case
One Deployment (*D1*)	Binary	Positive
Two Deployments (*D2*)	Binary	Positive
≥ 2 Deployments (*D3*)	Binary	Positive
Zero Non-Hostile Deployments (N0)	Binary	Base Case
One Non-Hostile Deployments (N1)	Binary	Positive
≥ 2 Non-Hostile Deployments (N23)	Binary	Positive
Zero Hostile Deployments (H0)	Binary	Base Case
One Hostile Deployment (H1)	Binary	Positive
≥ 2 Hostile Deployments (H23)	Binary	Positive
0 Non- and 0 Hostile Deployments (N0H0)	Binary	Positive
0 Non- and ≥ 1 Hostile Deployment (N0H)	Binary	Base Case
1 Non- and 0 Hostile Deployments (N1H0)	Binary	Positive
1 Non- and ≥ 1 Hostile Deployment (N1H)	Binary	Positive
≥2 Non- and 0 Hostile Deployments (N23H0)	Binary	Positive
≥2 Non- and ≥ 1 Hostile Deployment (N23H)	Binary	Positive

SOURCE: Author

V. POOLED DEPLOYMENT MODEL RESULTS

A. DEPLOYMENT MODELS

Initially the data for the Pre-9/11 and Post-9/11 (GWOT) periods were pooled and a single logit model was estimated. This model includes the variables indicated in Chapter III. The key variables for this model were the total deployments variables *D0, D1, D2,* and *D3*, as well as the dummy variable *GWOT*. This model is labeled as the "*Total Deploymen*ts" model. Subsequently, separate logistic regression models were run for the Pre-9/11 and GWOT groups.

The deployment variables were constructed using the definition of deployment presented in Chapter IV in order to identify whether an individual had no deployments (*D0*), one deployment (*D1*), two deployments (*D2*), or more than two deployments (*D3*). This model does not differentiate between hostile and non-hostile deployments. The effects of the total deployments variables allow for an evaluation of the influence that OPTEMPO has on retention.

A second logistic regression model was developed to evaluate the effects of non-hostile and hostile deployments. Six deployment-type variables identify whether an individual has experienced zero non-hostile deployments (*N0*), one non-hostile deployment (*N1)*, multiple non-hostile deployments (*N23*), zero hostile deployments (*H0*), one hostile deployment (*H1*), or multiple hostile deployments (*H23*). The effect of each of these deployment-type variables allows for a more precise evaluation of the effect that increased OPTEMPO has on retention. These variables were created based upon the Hosek and Totten (2002) RAND study evaluating the effect of deployments on retention in all four of the Services. This model is labeled as the "*Non Interacted*" model. Subsequently, separate logistic regression models that included the non-interacted deployment-type variables were run for the Pre-9/11 and GWOT groups.

A final logistic regression model was developed to better evaluate the effect of non-hostile and hostile deployments. The deployment-type variables from the "*Non Interacted*" model are combined to create interaction terms. The interaction variables

identify whether an individual has zero non-hostile and zero hostile deployments (*N0H0*), zero non-hostile and at least one hostile deployment, (*N0H*), one non-hostile and zero hostile deployments (*N1H0*), one non-hostile and at least one hostile deployment (*N1H*), multiple non-hostile and zero hostile deployments (*N23H0*), and multiple non-hostile and at least one hostile deployments (*N23H*). The effect of each of the interacted deployment-type variables allows for an even more precise evaluation of the effect that increased OPTEMPO has on retention. These variables were created based upon the Hosek and Totten (2002) RAND study evaluating the effect of deployments on retention in all four of the Services. This model is labeled as the "*Interacted*" model. Subsequently, separate logistic regression models that include the interacted deployment-type variables were run for the Pre-9/11 and GWOT groups.

The dummy variable *GWOT* was created based upon the Post-9/11 (GWOT) group. This variable is an indicator of Marine aviators whose Expiration of Active Obligated Service (EAOS) occurred between October 2001 and June 2005. This variable is included in each of the pooled models and allows for an evaluation of the effect that the Global War on Terror (GWOT) has had on the retention behavior of Marine aviators. When evaluated in conjunction with the effect of the deployment-type variables, the effect that the increased OPTEMPO resulting from the GWOT has had on the retention of Marine Corps aviators can be determined.

B.   RETENTION OF POOLED MARINE AVIATORS (1995-2005)

1.   Model Goodness of Fit

a.   *Global Null Hypothesis*

In order to determine the "goodness of fit" of a model, there are three distinct criteria to be evaluated, the first of which is the Global Null Hypothesis, which tests for the overall significance of the logit model. The Global Null Hypothesis states that none of the explanatory variables in the model has an effect on the dependent variable '*stay*'. The alternative hypothesis is that at least one of the explanatory variables has an effect on the variation in the dependent variable.

In order to determine whether to accept the Global Null Hypothesis or reject it for a logistic regression model, one must evaluate the Likelihood Ratio based on

the Chi-Square statistic. As shown in Table 5.1, the Likelihood Ratios for the pooled models are all significant at the .01 level. Therefore, it can be concluded that at least one of the explanatory variables is significant in explaining the variation in the dependent variable for all three pooled models.

Table 5.1   Global Null Hypothesis Test for Pooled Logit Models

Testing Global Null Hypothesis: BETA = 0				
Model	Likelihood Ratio	Chi-Squared	DF	Pr>ChiSq
Total Deployments	1834.145	660.1122	20	<.0001
Non-Interacted	1847.83	646.4272	21	<.0001
Interacted	1833.303	660.9550	22	<.0001

Source: Author

b.   *R-Square*

A second goodness of fit criterion is the Generalized R-Square and the Max-Rescaled R-Square of the model. The Generalized R-Square is defined as the fraction of the variation in the dependent variable that is explained by the independent variables. In a logistic regression model, the Generalized R-Square value has an upper bound that is less than one because of the dependent variable being discrete. The Max-Rescaled R-Square adjusts the Generalized R-Square and allows for a maximum value of one and, therefore, the Max-Rescaled R-Square value is preferred.

As shown in Table 5.2, the Generalized R-Square values are approximately 0.21 and the Max-Rescaled R-Square values are approximately 0.35 for the three models. This indicates that approximately 35% of the variation in the *'stay'* variable is related to the variation in the dependent variables in the each of the three pooled models.

Table 5.2   Generalized R-Square and Max-Rescaled R-Square for the Pooled Logit Models

Model	Generalized R-Square	Max-Rescaled R-Square
Total Deployments	0.2126	0.3575
Non Interactive	0.2087	0.3509
Interactive	0.2128	0.3579

Source: Author

c.   Classification Table

A third method used to determine goodness of fit is the Classification Table, which determines the accuracy of the prediction by comparing the predicted outcomes with the actual results. As Table 5.3 indicates, the pooled models correctly classify approximately 72.5% of the individuals in each of the three models based upon a probability cut-off level of 0.840, which corresponds to the actual proportion of '*stayers'* among the Marine aviators included in the model. "Sensitivity" indicates the percentage of the '*stayers'* in the sample that were correctly predicted as staying. As Table 5.3 indicates, these models correctly classify approximately 69.5% of the '*stayers'* in each of the three pooled models. "Specificity" indicates the percentage of leavers in the sample that are correctly predicted as separating. As Table 5.3 indicates, these models correctly classify approximately 88.4% of those who separated in each of the three pooled models.

Table 5.3   Classification Table for the Pooled Logit Models

Model		Correct		Incorrect		Percentages				
Type	Prob Level	Event	Non Event	Event	Non Event	Correct	Sensitivity	Specificity	False Pos	False Neg
Total Deployments	0.840	1602	409	53	698	72.8	69.7	88.5	3.2	63.1
Non Interacted	0.840	1591	408	54	709	72.4	69.2	88.3	3.3	63.5
Interacted	0.840	1600	408	54	700	72.7	69.6	88.3	3.3	63.2

Source: Author

2. Interpretation and Evaluation of Coefficients

Of the 20 variables used in the Pooled Total Deployments Regression Model, 15 are statistically significant. Of the 21 variables used in the Pooled Non-Interacted Regression Model, 16 are statistically significant. Of the 22 variables used in the Pooled Interacted Regression Model, 18 are statistically significant. The variables and significance levels are shown in Table 5.4. The results shown are for a one-tailed test, with the exception of the *FAC* variable that uses a two-tailed test. These variables are evaluated with a one-tailed test in order to evaluate the hypotheses stated in Chapter IV. Since the FAC variable did not have a hypothesized effect, a two-tailed test will allows us to determine the sign of any effect that may be present.

Table 5.4   Logit Results for Pooled Data (N=2,762)

Variable	Total Deployments Model		Non Interacted Model		Interacted Model	
	Parameter Estimates	Pr>ChiSq	Parameter Estimates	Pr>ChiSq	Parameter Estimates	Pr>ChiSq
Age	-0.8870	0.03755**	-0.9529	0.0269**	-0.8877	0.03765**
Age Squared	0.0114	0.05655*	0.0124	0.04105*	0.0114	0.05655*
Minority	0.1105	0.3390	0.1007	0.3515	0.1242	0.3207
Female	0.2199	0.2963	0.2230	0.2927	0.1802	0.3304
MWC	0.2936	0.0191**	0.3227	0.0111**	0.3018	0.22935
MNC	0.1467	0.0879*	0.1428	0.20865	0.1314	0.03945**
SWC	1.1621	0.0365**	1.0877	0.04605**	1.1385	<.0001***
ROTC	0.1223	0.2966	0.0942	0.33995	0.1133	0.3108
OCS	0.4619	0.0047***	0.4304	0.00765***	0.4455	0.0062***
Prior_Enl	0.4161	0.1498	0.4286	0.07575*	0.4554	0.06495*
RWP	-1.2767	<0.0001***	-1.2997	<0.0001***	-1.2824	<0.0001***
NFO	-1.3513	<0.0001***	-1.3820	<0.0001***	-1.3472	<0.0001***
WTI	0.7969	<0.0001***	0.8111	<0.0001***	0.7978	<0.0001***

FAC#	0.2557	0.1029	0.2633	0.1909	0.2617	0.1947
PV_thou	*0.0105*	*<0.0001****	*0.0102*	*<0.0001****	*0.0106*	*<0.0001****
Hires_thou	*-0.1579*	*<0.0001****	*-0.1584*	*<0.0001****	*-0.1601*	*<0.0001****
GWOT	**-3.3765**	**<0.0001*****	**-3.3571**	**<0.0001*****	**-3.3880**	**<0.0001*****
D1	**-0.8969**	**<0.0001*****				
D2	**-0.5445**	**0.0011*****				
D3	**-0.6099**	**0.0006*****				
N1			**-0.2010**	**0.07155***		
N23			**-0.2801**	**0.07085***		
H1			**-0.3867**	**0.0050*****		
H23			**-0.2065**	**0.0768***		
N0H					**-0.6527**	**0.0001*****
N1H0					**-1.1064**	**<0.0001*****
N1H					**-0.5577**	**0.00225*****
N23H0					**-0.5703**	**0.0220****
N23H					**-0.8392**	**0.0013*****

SOURCE: Author   ***** Significant at the .01 level   **Significant at the .05 level   *Significant at the .10 level**

 # Coefficients shown are for a two-tailed test.

The *AGE* variable is statistically significant in all three pooled models and its effect on a Marine aviator's decision to stay is negative. The *AGE SQUARED* variable is also significant, but is positive in its effect on the retention decision. These variables are also jointly significant in all three pooled models, which leads to the conclusion that age has a negative but diminishing effect on retention up to a certain point after which the effect becomes positive. For all three models, age has a negative effect on retention until the aviator reaches 39 years of age, the turning point for the quadratic equation. Once an aviator reaches 39 years of age, the likelihood to remain in the Marine Corps increases as

his age increases. It is possible that once a Marine reaches this age, he desires more stability because of family responsibilities and may assume that he has reached a point in his military career at which a change of employment is not a practical option.

Most of the marital status and dependency variables are significant. The variable for single with children (SWC) is significant and positive in all three pooled models, indicating that single parents are more likely to stay than are single Marines with no dependents. The married with children (MWC) variable is also positive and significant in the Pooled Total Deployments and Pooled Non-Interacted Models, but is not significant in the Pooled Interacted Model. This indicates that those aviators who are married and have children are more likely to stay than are single Marines without children. Finally, the variable for married without children (MNC) is significant in the Pooled Total Deployments and Pooled Interacted Models indicating that those aviators who are married and have no children are more likely to stay than single Marines with no children. Marital status and dependency may be significant because individuals with dependents are likely to have a stronger desire for stable employment situations than those who are single with no children. This may be due to the need and desire to support a family.

The commissioning source variables are jointly significant in the pooled models, indicating that commissioning source affect on the retention decision. The base case is the variable *ACADEMY*; *ROTC* and *OCS* graduates are compared to *ACADEMY* graduates. *ROTC* graduates are not significantly different from *ACADEMY* graduates in their retention behavior. This may be because *ROTC* graduates are similar to Academy graduates in that they have recognized a desire to serve early in their collegiate education. *OCS* graduates, however, show a significantly higher likelihood to stay than *ACADEMY* graduates. This appears to be explained by the inclusion of Enlisted Commissioning Programs in this category. It was not possible to separate those individuals who participated in Enlisted Commissioning Programs from all others who attended Officer Candidate School. Therefore, it is likely that the number of prior enlisted Marines affected the results for all *OCS* graduates.

The *PRIOR_ENL* variable is positive and significant in the Pooled Non-Interacted and Interacted Models, indicating that having prior enlisted service increases the retention probability. The positive and significant effect of prior enlisted service on an aviator's retention behavior is most likely due to the matching theory. These aviators have already displayed an affinity for the Marine Corps lifestyle indicated by their choosing to transition from the enlisted ranks to the officer ranks, thus increasing their service commitment. Likewise, by selecting these individuals for commissioning programs, the Marine Corps has indicated that it is satisfied with their performance and wants to continue their employment.

The type of aviator variables are jointly significant in all three pooled models, indicating that the type of aviator affects retention. The base case for this variable is *FIXED WING PILOT* (*FWP*), with which *ROTARY WING PILOTS* (*RWP*) and *NAVAL FLIGHT OFFICERS* (*NFO*) are compared. Both *RWP* and *NFO* are individually significant as well as jointly significant. Both variables also have a negative effect on retention behavior. This can be explained because of the service obligation and the time-to-train. *ROTARY WING PILOTS* and *NAVAL FLIGHT OFFICERS* incur a six-year service obligation upon being designated as naval aviators, while *FIXED WING PILOTS* incur an eight-year obligation. *ROTARY WING PILOTS* and *NAVAL FLIGHT OFFICERS* undergo two years or less of training, while *FIXED WING PILOTS* undergo more than two years of training. This difference in time-to-train coupled with the length of the service obligation means that *FIXED WING PILOTS* will be older and have more time-in-service than other aviators when the retention decision is made. Therefore, it is understandable that *ROTARY WING PILOTS* and *NAVAL FLIGHT OFFICERS* are more likely to separate than *FIXED WING PILOTS*.

The *WTI* variable is positive and significant in the pooled models, indicating that the Weapons and Tactics MOS has a positive effect on the retention decision. Those individuals who obtain the Additional MOS as *WTI*s are the most highly trained aviators in the Marine Corps. The Marine Corps has made a large investment in these individuals,

and generally rewards these individuals with choice assignments. As a result, individuals with the WTI MOS are more likely to be satisfied and choose to stay in the Marine Corps than others.

The present value of the future annual payments of Aviation Continuation Pay (*PV_THOU*) is positive and significant in the pooled models, indicating that the aviation bonus has a positive effect on the retention decision of aviators. The average present value of ACP for the pooled aviators is $40,976.

The *HIRES_thou* variable is significant and negative in the pooled models, indicating that the number of annual airline hires has a negative effect on the retention of Marine Corps aviators. This may be caused by the benefits associated with employment in the civilian airline industry. The civilian airline industry offers better wages and more flexible schedules than the military. This pay differential and flexibility in scheduling appears to entice aviators into separating.

The dummy variable GWOT is significant and negative, indicating that the Global War on Terror has had a negative effect on the retention of Marine Corps aviators. This negative effect is most likely the result of the increased OPTEMPO and hazardous duty required of those Marines serving since the GWOT began. The relatively high coefficient associated with the dummy variable *GWOT* is most likely explained by the differences between the portion Pre-9/11 and GWOT aviators who chose to stay. Pre-9/11 aviators have a much higher proportion of '*stayers*' than GWOT aviators, 97% and 66%, respectively. The high coefficient is most likely attributable to this difference in proportions.

For the Pooled Total Deployments Model, the deployment variables are both jointly and individually significant, as well as negative in effect. This indicates that deployments have a negative effect on retention. The base case for this variable is zero deployments (*D0*). These deployment variables indicate that as the number of deployments increases, the likelihood of separating also increases. The largest effect results from one deployment (*D1* = -0.8969). The next largest effect results from more than two deployments (*D3* = -0.6099), which has a larger effect than two deployments

(*D2* = -0.5445). Deployments most likely negatively affect an aviator's decision to stay due to the perceived hardship of being deployed and being separated from family. After the first deployment, Marines learn about the deployment and separation experiences. The hardship associated with deploying is likely to be the reason that many aviators choose to separate rather than continue to deploy.

For the Pooled Non-Interacted Model, non-hostile and hostile deployments are tested independently. The base case for non-hostile deployments is zero non-hostile deployments. Both of the non-hostile variables are negative and significant indicating that the number of non-hostile deployments has a negative effect on the retention decision of Marine aviators in the pooled period. The most likely explanation for the negative effect of non-hostile deployments is the presence of significant stressors related to family separation. When a Marine is separated from his family, he has a certain amount of stress associated with concern for the well-being of family members left behind, which may have a negative effect on a Marine's desire to deploy. If a Marine does not want to deploy, even under non-hostile conditions, then he is most likely identifying himself as not being satisfied and being incompatible with the Marine Corps life.

For the Pooled Non-Interacted Model, the base case for hostile deployments is zero hostile deployments. The hostile deployment variables indicating one hostile deployment (*H1*) and multiple hostile deployments (H23) are also both negative and significant, indicating that the number of hostile deployments has a negative effect on the retention decision of Marine aviators. The most likely explanation for this is the stressors and hardships related to hostile deployments. Hostile deployments indicate that an individual participated in combat operations and most likely came under fire by hostile forces, while non-hostile deployments are generally benign. The stress related to daily combat operations coupled with the Spartan living conditions associated with combat zones appear to lead aviators to separate.

For the Pooled Interacted Model, all of the interacted variables are individually significant as well as jointly significant. These interacted variables show that deployments have a negative effect on the Marine aviator's retention decision. The base

case is an individual with zero deployments. Each of the interacted deployment variables shows that deployments have a negative effect on retention. The largest effect is for individuals with one non-hostile and zero hostile deployments (*N1H0*). The next largest effect is for those who have multiple non-hostile deployments and at least one hostile deployment (*N23H*), followed by those with zero hostile and at least one hostile deployment (*N0H*), one non-hostile and at least one hostile deployment (*N1H*), and multiple non-hostile and zero hostile deployments (*N23H0*). Marines who deploy most frequently to combat zones are the most likely to separate. This is largely due to the extreme hardship and stress endured during combat deployments.   Non-hostile deployments generally occur aboard a comfortable ship at sea, while hostile deployments occur in harsh areas with minimal comfort and support available and include an increased risk of death. Therefore, the hostile deployments, in general a greater negative effect on retention.

3.   Partial Effects

a.   *Notional Person (Base Case)*

The notional person approach is used to calculate the partial effect of each explanatory variable on the probability of retention. The notional person is assigned the mean value for the continuous variables and a value of zero for all binary variables. Once the notional person's individual characteristics are established, each explanatory variable can be altered to determine its partial effect on the retention probability. This is done by increasing the value of each variable while holding the other variables constant at their mean value and calculating the effect on the probability of retention.

For the Pooled Sample group, the notional person has an 83.27% probability of staying in the Marine Corps. The notional person in the Pooled Sample group is 32.5 years old, white, male, single with no children, a service academy graduate, not prior enlisted, a Fixed-Wing Pilot, with 11 years of service, no deployments, received $40,976 of ACP, and 3,880 airline pilots were hired the year of his EAOS.

b.   *Partial Effects*

Table 5.5 shows the partial effects of all significant variables in the Pooled Sample group logistic regression models.   The notional person (base case) has a

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probability of staying of 83.27%. For an aviator with the same characteristics as the notional person but one year older, the likelihood of staying is reduced by 1.39 percentage points for the Deployment Model, 1.94 percentage points when using the Non-Interacted Model, and 1.35 percentage points when using the Interacted Model.

For an aviator who is married with children, the likelihood of staying increases by a mere 0.3 percentage points over an aviator who is single with no children. An aviator who is married with no children has a likelihood of staying that is 0.13 percentage points higher than an aviator who is single with no children. Also, an aviator who is a single parent is 0.7 percentage points more likely to stay than a single aviator with no children. An OCS graduate will have an increased likelihood of staying of 0.4 percentage points over the notional person, who is a Service Academy graduate.

Rotary Wing Pilots and Naval Flight Officers have an increased likelihood of staying of approximately 3.0 percentage points over Fixed Wing Pilots (who are the base case). Those pilots who have the WTI MOS have an increased likelihood of staying of approximately 0.5 percentage points.

The economic factors that affect the probability of staying are the Present Value of Aviation Continuation Pay (ACP and the annual number of pilots hired by the commercial airline industry. For every \$1,000 in present value of ACP that an aviator receives above the mean (\$40,976), the likelihood of staying increases by .008 percentage points, and for every 1,000 pilots hired by the airline industry above 3,380 pilots, the likelihood of an aviator staying decreases by approximately .15 percentage points.

The pooled model results indicate that deployments have a negative impact on a Marine aviator's retention decision. The notional person had been deployed zero times. Those aviators who have one deployment are 1.46 percentage points less likely to stay than those with no deployments. Those aviators with two deployments and those with more than two deployments have a decreased likelihood of staying of 0.739 and 0.388 percentage points, respectively.

The notional person in the Pooled Non-Interacted Model has zero non-hostile deployments and zero hostile deployments. Aviators with one non-hostile

deployment are 0.29 percentage points less likely to stay than aviators with no non-hostile deployments. Aviators with multiple non-hostile deployments are 0.42 percentage points less likely to stay than the notional person. Aviators with one hostile deployment have a likelihood of staying that is 0.1 percentage points lower than those who have zero hostile deployments. Aviators with multiple hostile deployments have a likelihood of staying that is 0.09 percentage points less than the notional person.

   The base case in the Pooled Interacted Model is an aviator with zero deployments. Those aviators with zero non-hostile deployments and at least one hostile deployment are 0.91 percentage points less likely to stay than aviators with no deployments. Aviators with one non-hostile and no hostile deployments have a likelihood of staying that is 1.96 percentage points lower than those who have never deployed. Aviators with one non-hostile and at least one hostile deployments have a decreased likelihood of staying of 0.3 percentage points. Aviators with multiple non-hostile and zero hostile deployments are 0.55 percentage points less likely to stay than those with zero deployments. Finally, aviators with multiple non-hostile and at least one hostile deployments have a likelihood of staying that is 1.0 percentage points lower than an aviator who has never deployed.

Table 5.5 Partial Effects for Pooled Logit Models

Variables	Partial Effects		
	Total Deployments	Non-Interacted	Interacted
Age	-0.01386**	-0.01944**	-0.01346**
OCS	+0.00367***	+0.00437***	+0.00344***
RWP	-0.02596***	-0.03389***	-0.02545***
NFO	-0.02865***	-0.03771***	-0.02773***
WTI	+0.00556***	+0.00715***	+0.00538***
PV_thou	+0.00011***	+0.00013***	+0.00010***
Hires_thou	-0.00174***	-0.00222***	-0.00172***

MNC	+0.00139*		+0.00122**
MWC	+0.00255**	+0.00352**	
SWC	+0.00697**	+0.00855**	+0.00668***
GWOT	-0.19768***	-0.23537***	-0.19731***
D1	-0.01463***		
D2	-0.00739***		
D3	-0.00388***		
N1		-0.00287*	
N23		-0.00420*	
H1		-0.00097***	
H23		-0.00089*	
N0H			-0.00907***
N1H0			-0.01963***
N1H			-0.00298***
N23H0			-0.00547**
N23H			-0.01009***

SOURCE: Author   ***** Significant at the .01 level **Significant at the .05 level   *Significant at the .10 level**

C.   POOLED RESULTS SUMMARY

The sample for the Pooled Model consists of all Marine Corps aviators who were eligible to separate between October 1994 and June 2005. This sample includes both Pre-9/11 and Post-9/11 aviators. The size of the sample is 2,762 aviators. The results of the pooled models show that deployments have a negative effect on the retention decision irrespective of whether they are hostile or non-hostile deployments. The fact that an individual is separated from his or her family while on deployment has historically been a factor in the retention decision.

The results of this study are different from the results of previous research. The Hosek and Totten (2002) RAND study took a similar approach to evaluating non-hostile and hostile deployments. Hosek and Totten (2002) found that when analyzed independently, non-hostile and hostile deployments have a positive effect on retention of service members(Hosek, James 2002, 106). Their research also showed that when non-hostile and hostile deployments are interacted with each other, there is a positive relationship between deployments and retention.(Hosek 2002, 108) These results are different from the results of this thesis. While Hosek and Totten (2002) found a positive relationship between deployment and retention, this thesis shows that the relationship is actually negative. Hosek and Totten's (2002) approach differs from this thesis in two important areas: the definition of deployment and the time period evaluated. They defined a deployment as any indication of Family Separation Allowance or Imminent Danger Pay. While these special pays do indicate that the service member was away from home for at least 30-days, they do not indicate whether the service member was participating in an OCONUS deployment or a CONUS training exercise. The psychological impact on the service member greatly differs between OCONUS deployments and CONUS training exercises, with OCONUS deployments having a much greater psychological effect. Also, the Hosek and Totten (2002) study evaluated retention behavior in the 1990s. While the 1990s may be indicative of previous decades, this period should not be used to evaluate the GWOT era. The 1990s were a period of relative stability throughout the world, while the GWOT era is recognized as being relatively unstable. Therefore, it is not appropriate to use the results of 1990s behavior in order to predict behavior in the GWOT period.

Other key factors in the retention of aviators in the pooled sample are the type of aviator, WTI MOS, and Aviation Continuation Pay. RWPs and NFOs are more likely to separate than FWPs. Part of the reason that RWPs are more likely to separate than FWPs is due to their OPTEMPO. RWPs can expect to deploy more frequently than FWPs. Since deployments have a negative effect on retention on the sample as a whole, it is understandable why RWPs would be separating at a higher rate than FWPs.

The *WTI* MOS is another issue that is identifiable in the pooled sample. As stated earlier, the WTI MOS is the equivalent to "Top Gun" for Marine pilots. Those individuals who possess this MOS have more qualifications than other pilots. Usually there is a significant divide between a WTI and the average pilot in the squadron with respect to qualifications. The average pilot has minimal qualifications and cannot perform certain missions, while the WTI has every qualification and can perform all missions. This creates a feeling of frustration among many pilots who feel capable, and are capable, of performing most missions required.

Finally, Aviation Continuation Pay continues to be a factor in the retention decision. The Department of Defense initiated the ACP program in order to increase retention of aviators. This was done after studies showed that paying aviators a bonus would be an effective retention tool. Therefore, it was expected that ACP would have an effect on the retention decision. For the pooled model, the effect is not very large, but it is still positive. ACP is an effective tool and will continue to be an effective tool to increase retention of aviators.

VI. PRE-9/11 AND POST-9/11 (GWOT) DEPLOYMENT MODELS RESULTS (SECOND REVISION)

A. DEPLOYMENT MODELS

In order to evaluate the determinants of retention in the periods before and after the Global War on Terror, the data are separated into Pre-9/11 and Post-9/11 (GWOT) samples. For each sub-sample the same three deployment models are estimated as for the pooled data. The first model for each time period is the Total Deployments Model, which estimates the effects of the total number of deployments by using indicators for one deployment (*D1*), two deployments (*D2*), and more than two deployments (*D3*). The second model for each time period is the Non-Interacted Model, which estimates the independent effects of non-hostile and hostile deployments (*N1*, *N23*, *H1*, and *H23*). The final model for each time period is the Interacted Model, which estimates the combined effects of non-hostile and hostile deployments (*N0H*, *N1H0*, *N1H*, *N23H0*, and *N23H*).

B. RETENTION OF PRE-9/11/2001 MARINE AVIATORS

1. Model Goodness of Fit

a. Global Null Hypothesis

The Global Null Hypothesis tests for the overall significance of the logit model. The Global Null Hypothesis is that none of the explanatory variables in the model has an effect on the dependent variable '*stay*'. The alternative hypothesis is that at least one of the explanatory variables has an effect on the variation in the dependent variable. As shown in Table 6.1, the Likelihood Ratios for the Pre-9/11 models are all significant at the .10 level. Therefore, it can be concluded that at least one of the explanatory variables is significant in explaining the variation in the dependent variable for each of the three Pre-9/11 models.

Table 6.1   Global Null Hypothesis Test for Pre-9/11 Logit Models

	Testing Global Null Hypothesis: BETA = 0			
Model	Likelihood Ratio	Chi-Squared	DF	Pr>ChiSq
Total Deployments	364.085	27.9288	18	0.0631
Non Interacted	360.939	31.0743	19	0.0396
Interacted	348.997	43.0167	20	0.0020

SOURCE: Author

b.   R-Square

A second goodness of fit criterion is the Generalized R-Square and Max-Rescaled R-Square of the model. As shown in Table 6.2, the Generalized R-Square values are 0.0181, 0.0201, and 0.0277, respectively, for the three models. The Max-Rescaled R-Square values for the Pre-9/11 models are 0.0800, 0.0899, and 0.1226. This indicates that between 8.0% and 12.26% of the variation in the *'stay'* variable is related to the variation in the dependent variables in each of the three Pre-9/11 models.

Table 6.2   Generalized R-Square and Max-Rescaled R-Square for the Pre-9/11 Logit Models

Model	Generalized R-Square	Max-Rescaled R-Square
Total Deployments	0.0181	0.0800
Non Interacted	0.0201	0.0899
Interacted	0.0277	0.1226

SOURCE: Author

c.   Classification Table

A third method used to determine goodness of fit is the Classification Table. As Table 6.3 indicates, the Pre-9/11 models correctly classify 46.8%, 48.5%, and 51.7% of the individuals based upon a probability cut-off level of 0.980, which corresponds to the actual proportion of "*stayers*" among the aviators included in the models. "Sensitivity" indicates the percentage of the '*stayers'* in the sample that are correctly predicted as staying. As Table 6.3 indicates, these models correctly classify 46.0%, 47.8%, and 51.2% of the '*stayers'* in each of the three Pre-9/11 models. "Specificity" indicates the percentage of separators in the sample that are correctly

predicted as separating. As Table 6.3 indicates, these models correctly classify 72.1%, 69.8%, and 67.4% of those who separated in each of the three Pre-9/11 models.

Table 6.3   Classification Table for the Pre-9/11 Logit Models

Model		Correct		Incorrect		Percentages				
Type	Prob Level	Event	Non Event	Event	Non Event	Correct	Sensitivity	Specificity	False Pos	False Neg
Total Deployments	0.980	685	31	12	803	46.8	46.0	72.1	1.7	96.3
Non Interacted	0.980	712	30	13	776	48.5	47.8	69.8	1.8	96.3
Interacted	0.980	762	29	14	726	51.7	51.2	67.4	1.8	96.2

SOURCE: Author

2.   Interpretation and Evaluation of Coefficients

Of the 18 variables used in the Pre-9/11 Total Deployments Regression Model, three are statistically significant. Of the 19 variables used in the Pre-9/11 Non-Interacted Regression Model, three are statistically significant. Of the 20 variables used in the Pre-9/11 Interacted Regression Model, four are statistically significant. The variables and significance levels are shown in Table 6.4. The results shown are for a one-tailed test, with the exception of the *FAC* variable that uses a two-tailed test.

Table 6.4   Logit Results for Pre-9/11 Data (N=1,531)

Variable	Total Deployments Model		Non Interactive Model		Interactive Model	
	Parameter Estimate	Pr>ChiSq	Parameter Estimate	Pr>ChiSq	Parameter Estimate	Pr>ChiSq
Age	-0.0700	0.4741	-0.0304	0.48885	-0.1039	0.4627
Age Squared	-0.00200	0.4491	-0.00250	0.43685	-0.00161	0.4601
Minority	-0.2979	0.3458	-0.3595	0.3160	-0.3884	0.30335

ROTC	-0.0246	0.48355	-0.0204	0.4863	-0.1119	0.4260
OCS	0.2818	0.2776	0.3423	0.23665	0.2533	0.30045
Prior_Enl	0.8643	0.2101	0.8893	0.2037	1.0173	0.1728
RWP	0.5444	0. 3007	0.5481	0.30085	0.4638	0.3232
NFO	1.2866	0.13935	1.2167	0.15495	1.1292	0.1644
WTI	*1.4081*	*0.0279***	*1.4158*	*0.0273***	*1.4391*	*0.02565***
FAC#	0.2581	0.6790	0.3383	0.5860	0.3422	0.5844
PV_thou	-0.00490	0.15905	-0.00589	0.1144	-0.00533	0.1413
Hires_thou	0.0272	0.3749	0.0233	0.39395	0.0115	0.4448
MWC	*0.5922*	*0.0527**	0.5868	0.0546	*-0.8116*	*0.0329***
MNC	0.3346	0.2233	0.2657	0.27395	0.2400	0.2949
SWC	0.2686	0.4012	0.2845	0.39535	0.2518	0.40775
D1	-0.2331	0.27525				
D2	*0.7447*	*0.05605**				
D3	0.3919	0.2388				
N1			*-0.5129*	*0.0695**		
N23			0.4512	0.21395		
H1			0.2088	0.27445		
H23			*1.1561*	*0.01945***		
N0H					*0.6403*	*0.07875**
N1H0					*-0.8116*	*0.0329***
N1H					0.3429	0.25475
N23H0					12.7699	0.48025
N23H					-0.7557	0.1097

SOURCE: Author   ***** Significant at the .01 level   **Significant at the .05 level   *Significant at the .10 level**

 # Coefficients shown are for a two-tailed test.

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The *AGE* variables are not individually significant in any of the three Pre-9/11 models, but they are jointly significant in each model, indicating that age has an effect on retention behavior of Pre-9/11 aviators. Since *AGE* is negative and *AGE SQUARED* is positive, it appears that age has a negative but diminishing effect on retention until the aviator reaches a certain age, the turning point, after which the effect on retention behavior becomes positive as age increases. The turning point for Pre-9/11 aviators is 32 years of age. This indicates that as age increases up to 32 years of age, Pre-9/11 aviators have a decreasing likelihood of staying. Once an aviator reaches 32 years of age, the likelihood of remaining in the Marine Corps becomes increasingly positive as his age increases.

Most of the marital status and dependency variables are not significant in the Pre-9/11 models. The exception is *MWC*, which has a positive effect on retention, indicating that an aviator in the Pre-9/11 period who is married with children is more likely to stay than an aviator who is single with no children. The variables MNC and SWC are not significant, indicating that they have no effect on the retention decision of Pre-9/11 aviators. *MWC* may be significant because individuals who are married with dependents may have a stronger desire for stable employment situations than others due to the need and desire to support a spouse and family.

The *WTI* variable is positive and significant in the Pre-9/11 models, indicating that individuals possessing the Weapons and Tactics MOS are more likely to stay than others. Those individuals who obtain the Additional MOS as *WTI*s are the most highly trained aviators in the Marine Corps. The Marine Corps has made a large investment in these individuals, and generally rewards these individuals with choice assignments. As a result, individuals with the *WTI* MOS are more likely to stay in the Marine Corps than those who do not have the MOS.

For the Pre-9/11 Total Deployments Model, the deployment variables are neither jointly nor individually significant, with the exception of the variable for two deployments (*D2*). *D2* is significant and has a positive effect on deployments. The most likely explanation for this is the relative stability of the Marine Corps and deployments during this period. During this period, deployments were planned far in advance and an

individual's deployment schedule could be anticipated with some certainty. This ability to make future plans may make deployments more palatable to Marine aviators and increases their satisfaction with Marine Corps life.

For the Pre-9/11 Non-Interacted Model, non-hostile and hostile deployments are tested independently. The base case for non-hostile deployments is zero non-hostile deployments. The variable indicating one non-hostile deployment (*N1*) is negative and significant, while multiple non-hostile deployments (*N23*) are not significant and non-hostile deployments are not jointly significant. This is most likely due to the relative utility assigned to deployments during this time period when deployments were routine and could be planned far in advance. Aviators in this period had the expectation of deploying twice prior to EAOS, and it appears that many looked forward to these two opportunities. Those individuals who only deployed one time had an expectation of two deployments, and when this did not occur, these individuals most likely were disappointed. This disappointment may have influenced these aviators to separate. Multiple non-hostile deployments are not significant in this model because two deployments were the standard, and all aviators expected to deploy two times prior to EAOS. Also, many of those individuals included in this deployment-type variable (*N23*) and have more than two deployments most likely self-selected for any deployment in excess of the standard number.

For the Pre-9/11 Non-Interacted Model, the base case for hostile deployments is zero hostile deployments. The variable indicating one hostile deployment (*H1*) is not statistically significant, while the variable for multiple hostile deployments (H23) is positive and significant. The hostile variables are also jointly significant indicating that hostile deployments have an effect on the retention decisions of Pre-9/11 aviators. The significance of the variable *H23* indicates that multiple episodes of hostile deployments have a positive effect on the retention decision of Marine aviators prior to 9/11. The most probable reason for multiple hostile deployments having a positive effect on retention is that hostile deployments occurred relatively infrequently during this period. It should be understood that the Marine Corps distinguishes itself from the other services with its esprit de corps and will to fight. Marines are expected to want the opportunity to

prove themselves in combat. Because of this, it is expected that those Marines who have seen combat will be more likely to stay than those who have never seen combat. It appears that those individuals who participated in multiple hostile deployments enjoyed applying their training in combat situations, which appears to have influenced them to be more likely to stay than those who did not participate in any hostile deployments.

For the Pre-9/11 Interacted Model, only two of the interacted variables are individually significant, but the interacted deployment variables are jointly significant. The joint significance of the interacted deployment variables indicates that deployments affect the retention decisions of Pre-9/11 aviators. The variables that are individually significant are zero non-hostile and at least one hostile deployment (*N0H*) and one non-hostile and no hostile deployments (*N1H0*). Individuals with zero non-hostile and at least one hostile deployment are more likely to stay than those aviators with zero deployments. This is most likely due to the relative infrequency of hostile deployments during the Pre-9/11 period. Also, individuals who participated in hostile deployments during this period most likely enjoyed applying their training in combat situations. During this period, combat was rare enough that it left participants with a feeling of satisfaction, which appears to have positively affected their retention behavior.

Aviators in the Pre-9/11 Interacted Model who participated in one non-hostile and zero hostile deployments are less likely to stay than aviators who had zero deployments. This is most likely due to the relative utility assigned to deployments during this time period. Pre-9/11 aviators had the expectation of deploying twice prior to EAOS, and it is likely that many looked forward to these two deployments. Those individuals who only deployed one time had an expectation of two deployments, and when this did not occur, these individuals may have been disappointed and this may have negatively influenced the retention decision of these aviators.

3. Partial Effects

a. *Notional Person (Base Case)*

Table 6.5 shows the partial effects of all significant variables in the Pre-9/11 Sample group. For the Pre-9/11 Sample group, the notional person has a probability of staying of 97.19%. The notional person in the Pre-9/11 Sample group is 32 years old,

white, single with no children, a service academy graduate, not prior enlisted, a Fixed Wing Pilot with no deployments, received $30,669 in present value of ACP, and 4,491 airline pilots were hired the year of his EAOS.

b. *Partial Effects*

The base case for marital status and dependents is single with no children. In the Pre-9/11 Total Deployments and Interacted Models, the variable for married with children (*MWC*) is significant and indicates that those who are married with children are approximately 12 percentage points more likely to stay than those aviators who are single without children. The WTI MOS has a positive and significant effect on retention. Aviators in the WTI MOS have a likelihood of staying of approximately 19 percentage points higher than those aviators who do not posses this MOS.

Finally, only four deployment variables were significant in their effects on Pre-9/11 aviators. In the Non-Interacted Model, the variable *H23*, multiple hostile deployments, has a positive effect on retention. Pre-9/11 aviators who make multiple hostile deployments, have a 17.76 percentage point increase in their likelihood to stay over those aviators who have zero hostile deployments. Also, the variable N1, one non-hostile deployment, has a negative effect on retention. Those Pre-9/11 aviators with one episode of non-hostile deployment are 7.0 percentage points less likely to stay than aviators with zero non-hostile deployments.

In the Pre-9/11 Interacted Model, the variable *N1H0* has a negative and significant effect on retention. An aviator with one non-hostile and zero hostile deployments is 9.37 percentage points less likely to stay than an individual who has zero deployments. Also, the variable N0H is positive and significant. An aviator with zero non-hostile and at least one hostile deployment is 13.5 percentage points more likely to stay than an aviator with zero deployments.

Table 6.5   Partial Effects of Pre-9/11 Deployment Logit Models

	Partial Effects		
Variables	**Total Deployments Model**	**Non-Interacted Model**	**Interacted Model**
MWC*	+0.12247		+0.11395
WTI**	+0.19663	+0.18795	+0.17806
N1*		-0.06979	
H23**		+0.17764	
N0H*			+0.13459
N1H0**			-0.09367

SOURCE: Author   ***** Significant at the .01 level   **Significant at the .05 level   *Significant at the .10 level**

C.   RETENTION OF POST 9/11/2001 (GWOT) MARINE AVIATORS

1.   Model Goodness of Fit

a.   *Global Null Hypothesis*

As shown in Table 6.6, the Likelihood Ratios for all three of the GWOT models are significant at the .01 level. Therefore, it can be concluded that at least one of the explanatory variables can explain the variation in the dependent variable for each of the three GWOT models.

Table 6.6   Global Null Hypothesis Test for GWOT Logit Models

Testing Global Null Hypothesis: BETA = 0				
Test	Likelihood Ratio	Chi-Squared	DF	Pr>ChiSq
Total Deployments	1429.976	148.8629	19	<.0001
Non Interacted	1444.527	134.3122	20	<.0001
Interacted	1429.879	148.9603	21	<.0001

SOURCE: Author

b. R-Square

As shown in Table 6.7, the Generalized R-Square values are approximately 0.11 and the Max-Rescaled R-Square values are approximately 0.15 for the GWOT models, indicating that approximately 15% of the variation in the *'stay'* variable is related to the variation in the dependent variables in the models. Given the value of the Max-Rescaled R-Square, it appears that these models have some value in explaining the retention behavior of Marine aviators.

Table 6.7   Generalized R-Square and Max-Rescaled R-Square for the GWOT Logit Models

Model	Generalized R-Square	Max-Rescaled R-Square
Total Deployments	0.1139	0.1576
Non Interacted	0.1034	0.1430
Interacted	0.1140	0.1577

SOURCE: Author

c. Classification Table

As Table 6.8 shows, these models correctly classify 63.4%, 62.6%, and 63.0% of the individuals in each of the three GWOT models based upon a probability cut-off level of 0.660, which corresponds to the actual proportion of '*stayers'* among the aviators included in the GWOT models. "Sensitivity" indicates the percentage of the '*stayers'* in the sample that are correctly predicted as staying. As Table 6.8 indicates, these models correctly classify 60.2%, 60.6%, and 59.1% of the '*stayers'* in each of the three GWOT models. "Specificity" indicates the percentage of separators in the sample that are correctly predicted as separating. As Table 6.8 indicates, these models correctly classify 69.7%, 66.6%, and 70.4% of those who separated in each of the three GWOT models.

Table 6.8   Classification Table for the GWOT Logit Models

Model		Correct		Incorrect		Percentages				
Type	Prob Level	Event	Non Event	Event	Non Event	Correct	Sensitivity	Specificity	False Pos	False Neg
Total Deployments	0.660	489	292	127	323	63.4	60.2	69.7	20.6	52.5
Non Interacted	0.660	492	279	140	320	62.6	60.6	66.6	22.2	53.4
Interacted	0.660	480	295	124	332	63.0	59.1	70.4	20.5	53.0

SOURCE: Author

2.   Interpretation and Evaluation of Coefficients

Of the 19 variables used in the GWOT Total Deployments Regression Model, 14 are statistically significant. Of the 20 variables used in the GWOT Non-Interacted Regression Model, 14 are statistically significant. Of the 21 variables used in the GWOT Interacted Regression Model, 16 are statistically significant.   The variables and significance levels are shown in Table 6.9. The results shown are for a one-tailed test, with the exception of the *FAC* variable that uses a two-tailed test.

Table 6.9   Logit Results for GWOT Aviator Data (N=1,231)

Variable	Total Deployments Model		Non Interacted Model		Interacted Model	
	Parameter Estimate	Pr>ChiSq	Parameter Estimate	Pr>ChiSq	Parameter Estimate	Pr>ChiSq
Age	*-0.9238*	*0.0557**	*-1.0306*	*0.0361***	*-0.9056*	*0.05875**
Age Squared	*0.0122*	*0.0714**	*0.0138*	*0.0470***	*0.0120*	*0.07495**
Minority	0.1660	0.28065	0.1629	0.2827	0.1796	0.26495
Female	0.1851	0.32815	0.1914	0.3212	0.1743	0.3378
ROTC	0.0825	0.3721	0.0551	0.2135	0.0541	0.8312
OCS	*0.4478*	*0..0115***	*0.4062*	*0.0192***	*0.4220*	*0.0323***
Prior_Enl	*-0.4684*	*0.07615**	*-0.4828*	*0.06955**	*-0.4890*	*0.0679**

RWP	*-1.8890*	*<.0001****	*-1.9176*	*<.0001****	*-1.8937*	*<.0001****
NFO	*-2.1923*	*<.0001****	*-2.2294*	*<.0001****	*-2.1881*	*<.0001****
WTI	*0.7408*	*0.0001****	*0.7759*	*0.0001****	*0.7419*	*0.0001****
FAC#	0.3125	0.1491	0.3069	0.1547	0.3098	0.1517
PV_thou	*0.0132*	*<.0001****	*0.0126*	*<.0001****	*0.0133*	*<.0001****
Hires_thou	*-0.2547*	*<.0001****	*-0.2532*	*<.0001****	*-0.2563*	*<.0001****
MWC	0.2239	0.07575*	0.2591	0.0953*	0.2301	0.07065*
MNC	0.1355	0.2417	0.1416	0.4634	0.1210	0.26745
SWC	*1.4714*	*0.03065***	*1.3831*	*0.0781**	*1.4379*	*0.0338***
D1	*-1.0500*	*<.0001****				
D2	*-0.7727*	*<.0001****				
D3	*-0.8131*	*<.0001****				
N1			-0.1379	0.1805		
N23			*-0.4225*	*0.0228***		
H1			*-0.5026*	*0.0014****		
H23			*-0.3679*	*0.00975****		
N0H					*-0.8731*	*<.0001****
N1H0					*-1.0705*	*0.0002****
N1H					*-0.7419*	*0.0003****
N23H0					*-0.9016*	*0.0003****
N23H					*-0.9669*	*0.0017***

SOURCE: Author   ***** Significant at the .01 level **Significant at the .05 level   *Significant at the .10 level**

 # Coefficients shown are for a two-tailed test.

The *AGE* and *AGE_SQUARED* variables are both individually and jointly significant in all three GWOT models, indicating that age has an effect on the GWOT period aviator's decision to stay. Since *AGE* is negative and *AGE SQUARED* is positive,

it appears that age has a negative but diminishing effect on retention behavior until the aviator reaches a certain age, the turning point, after which the effect becomes positive as age increases. The turning point for GWOT aviators is 37 years of age. This indicates that as age increases up to 37 years of age, GWOT aviators have a decreasingly negative likelihood of staying. Once an aviator reaches 37 years of age, the likelihood of remaining in the Marine Corps increases with age.

Most of the marital status and dependency variables are significant in the GWOT models. The base case is an aviator who is single with no children. The variable *MWC* is positive and significant in all three models, indicating that an aviator who is married with children is more likely to stay than an aviator who is single with no children. The variable *SWC* is also positive and significant in all three models, indicating that an aviator who is a single parent is more likely to stay than an aviator who is single with no children. The variable *MNC* is not significant in any of the models, indicating that being married but not having children does not affect the retention decision. The significance of the *MWC* and *SNC* variables is most likely because individuals who have dependents are more likely to have a stronger desire for stable employment situations than those without dependents. This is most likely due to the need and desire to support a family.

The commissioning source variables are jointly significant in the GWOT models, indicating that commissioning source affects the retention decision of GWOT period aviators. The base case is the variable *ACADEMY*; *ROTC* and *OCS* graduates are compared to *ACADEMY* graduates. While *ROTC* graduates are not significantly different from *ACADEMY* graduates in their retention behavior in the GWOT models, *OCS* graduates show a significantly higher likelihood to stay than *ACADEMY* graduates. This can be explained by the inclusion of Enlisted Commissioning Programs in this category. It was not possible to separate those individuals who participated in Enlisted Commissioning Programs from all others who attended Officer Candidate School. Therefore, it is likely that the number of prior enlisted Marines affected the results for all *OCS* graduates.

The *PRIOR_ENL* variable is positive and significant in all three of the GWOT models, indicating that having prior enlisted service has an effect on the retention

decision of GWOT period aviators. The positive and significant effect that having prior enlisted service has on an aviator's retention behavior is most likely due to the matching theory. These aviators have already displayed an affinity for the Marine Corps lifestyle indicated by their choosing to transition from the enlisted ranks to the officer ranks and thus, increase their service commitment. Likewise, by selecting these individuals for commissioning programs, the Marine Corps has indicated that it is satisfied with their performance and wants to continue their employment.

The type of aviator variables are jointly significant in all three GWOT models, indicating that the type of aviator affects retention in the GWOT period. The base case for this variable is *FIXED WING PILOTS* (*FWP*), with which *ROTARY WING PILOTS* (*RWP*) and *NAVAL FLIGHT OFFICERS* (*NFO*) are compared. Both *RWP* and *NFO*, individually, negatively affect retention in the GWOT period. This can be explained because of the service obligation and time-to-train. *ROTARY WING PILOTS* and *NAVAL FLIGHT OFFICERS* incur a six-year obligation upon being designated as naval aviators while *FIXED WING PILOTS* incur an eight-year obligation. *ROTARY WING PILOTS* and *NAVAL FLIGHT OFFICERS* undergo two years or less of training, while *FIXED WING PILOTS* undergo more than two years of training. This difference in time-to-train coupled with the length of the service obligation indicates that *FIXED WING PILOTS* will be older and have more time-in-service than other aviators when they make the retention decision. Another explanation is the result of fewer opportunities being available to *FIXED WING PILOTS* in the civilian airline industry during this period when compared to the Pre-9/11 period. Since 9/11, airline pilot hires have decreased while furloughs have increased. For a *FIXED WING PILOT* who has served 10 years at EAOS, the lack of stability of the commercial airline industry most likely forces him to view staying in the military as the best available option.

The *WTI* variable is positive and significant in the GWOT models, indicating that individuals in the Weapons and Tactics MOS are more likely to stay than others. Individuals who obtain the Additional MOS as *WTI*s are the most highly trained aviators in the Marine Corps. The Marine Corps has made a large investment in these individuals,

and generally rewards these individuals with choice assignments. As a result, individuals with the *WTI* MOS are more likely to stay in the Marine Corps than others.

The present value of the future annual payments of Aviation Continuation Pay (*PV_THOU*) is significant in the GWOT models, indicating that the aviation bonus has a positive effect on the retention decision of aviators. The average present value of ACP for the GWOT aviators is $53,796.

The *HIRES_THOU* variable is significant and negative in the GWOT models, indicating that the number of pilots hired annually by the commercial airline industry has a negative effect on the retention decision of Marine Corps aviators in the GWOT period. This is most likely due to the benefits associated with employment by the civilian airline industry. The civilian airline industry offers better wages and more flexible schedules than the military. This pay differential and flexibility in scheduling appears to entice aviators into separating.

For the GWOT Total Deployments Model, the deployment variables are all negative and are both jointly and individually significant. This indicates that deployments have a negative effect on the retention behavior of GWOT period aviators. The base case for this variable is zero deployments (*D0*). The deployment variables indicate that as the total number of deployments increases, the likelihood of separating also increases. It is most probable that an increase in the total number of deployments negatively affects an aviator's decision to stay due to the perceived hardship of being deployed and being separated from family. In addition, with the Global War on Terror, no clear end is in sight. For those aviators in the GWOT period, the only certainty in their future is more frequent deployments. The increased OPTEMPO of seven months deployed followed by seven months at home has caused many individuals to realize that during the course of the standard four year tour with their first FMF squadron, they can expect to deploy at least three times. In addition, most, if not all, of these deployments can be expected to be to either Iraq or Afghanistan, which place them in harms way. It may be that the expectation of future deployments to these hostile areas has led GWOT period aviators to reveal a negative relationship between deployments and retention.

For the GWOT Non-Interacted Model, non-hostile and hostile deployments were tested independently. The base case for non-hostile deployments is zero non-hostile deployments. Both of the non-hostile variables, *N1* and *N23*, are negative and individually significant indicating that the number of non-hostile deployments has a negative effect on the retention decision of Marine aviators in the GWOT period. The most likely explanation for the negative effect of non-hostile deployments is the presence of significant stressors related to family separation. When a Marine is separated from his family, he has a certain amount of stress associated with concern for the well being of family members left behind, which may have a negative effect on a Marine's desire to deploy. If a Marine does not want to deploy, even under non-hostile conditions, then he may feel that he is incompatible with the Marine Corps life.

For the GWOT Interacted Model, all of the interacted variables are individually significant as well as jointly significant. These interacted variables indicate that deployments have a negative effect on the Marine aviator's retention decision. The base case is an individual with zero deployments. These variables show the negative effect that the increased OPTEMPO created by the GWOT has had on the retention of Marine Corps aviators. The strong negative effect of deployments may indicate that GWOT period aviators have become exhausted with deploying. Deployments are more plentiful and more frequent in the GWOT period. This coupled with the decreased retention rate

of the period means that fewer individuals are available to carry the increased burden of deployments. With this knowledge, Marines may be more likely to separate than continue to deploy in support of the Global War on Terror.

3. Partial Effects

a. *Notional Person (Base Case)*

Table 6.10 shows the partial effects of all significant variables in the GWOT models. For the GWOT Sample, the notional person has a probability of staying of 65.96%. The notional person in the GWOT Sample group is 33 years old, white, single with no children, an service academy graduate, not prior enlisted, a Fixed-Wing Pilot with no deployments, received $53,796 in present value of ACP, and 3,121 airline pilots were hired the year of his EAOS.

b. *Partial Effects*

The base case for marital status and dependency is an aviator who is single with no children. An aviator who is married with children has a likelihood of staying of approximately 7.5 percentage points higher than the notional person. An aviator who is single with children is 19 percentage points more likely to stay than the notional person.

An aviator who is an *OCS* graduate is approximately 14 percentage points more likely to stay than an *ACADEMY* graduate. An aviator who has prior enlisted service is 7.5 percentage points more likely to stay than an aviator who has no prior enlisted service.

The base case for the GWOT models is a Fixed Wing Pilot (FWP). When compared to a Fixed Wing Pilot, both Rotary Wing Pilots (RWP) and Naval Flight Officers (NFO) are less likely to stay. RWPs have a likelihood of staying that is approximately 25 percentage points less than a FWP. NFOs have a likelihood of staying that is approximately 30 percentage points less than a FWP. The WTI MOS has a positive and significant effect on retention. Those aviators who possess the WTI MOS have a likelihood of staying of approximately 15 percentage points greater than those aviators who do not posses this MOS.

Financial variables also play a role on the retention decision of GWOT period aviators. The likelihood to stay increases by 0.3 percentage points for every

$1000 increase in the average Present Value of Aviation Continuation Pay ($53,796). Also, for every 1,000 pilots that are hired by the commercial airline industry, a GWOT period aviator is 3.7 percentage points less likely to stay than the notional person.

Finally, nearly all of the deployment variables are significant and have a negative effect on the retention decision of GWOT period aviators. For the GWOT Total Deployments Model, those aviators with one deployment have a likelihood of staying that is 18.5 percentage points less than an aviator with zero deployments. Aviators with two deployments have a likelihood of staying that is 11.2 percentage points less than aviators with zero deployments. Aviators with more than two deployments have a likelihood of staying that is 13.5 percentage points less than those with zero deployments.

For the GWOT Interacted Model, the base case for non-hostile deployments is zero non-hostile deployments, and the base case for hostile deployments is zero hostile deployments. Those aviators with more than one non-hostile deployment are 7.1 percentage points less likely to stay than aviators with zero non-hostile deployments. Aviators with one hostile deployment are 8.2 percentage points less likely to stay, and those with more than one hostile deployment are 4.6 percentage points less likely to stay than aviators with zero hostile deployments.

For the GWOT Interacted Model, the notional person has zero deployments. Aviators with zero non-hostile and at least one hostile are 13.7 percentage points less likely to stay than aviators with zero deployments. Aviators with one non-hostile and zero hostile deployments are 22.5 percentage points less likely to stay than the notional person. Aviators with one non-hostile and at least one hostile deployments are 9.7 percentage points less likely to stay than aviators with zero deployments. Aviators with multiple non-hostile and zero hostile deployments are 18.6 percentage points less likely to stay than aviators with zero deployments. Aviators with multiple non-hostile and hostile deployments have a likelihood of staying of 11.7 percentage points less than the notional person.

Table 6.10   Partial Effects GWOT Deployment Logit Model

Variables	Partial Effects		
	Total Deployments Model	**Non-Interacted Model**	**Interacted Model**
Age	-0.30717*	-0.31095**	-0.30349*
OCS	+0.14733**	+0.14783**	+0.13598**
Prior_Enl	+0.07374*	+0.08191*	+0.07503*
RWP	-0.24141***	-0.26247***	-0.25064***
NFO	-0.29661***	-0.31660***	-0.30637***
WTI	+0.14798***	+0.16082***	+0.14101***
PV_thou	+0.00318***	+0.00321***	+0.00309***
Hires_thou	-0.03623***	-0.03892***	-0.03672***
MWC	+0.07870*	+0.08563*	+0.05198*
SWC	+0.19096**	+0.19518*	+0.17923**
D1	-0.18514***		
D2	-0.11206***		
D3	-0.12526***		
N23		-0.07080**	
H1		-0.08172***	
H23		-0.04555***	
N0H			-0.13668***
N1H0			-0.22491***
N1H			-0.09749***
N23H0			-0.18594***
N23H			-0.11655**

SOURCE: Author   ***** Significant at the .01 level   **Significant at the .05 level   *Significant at the .10 level**

D.   COMPARISON OF THE RESULTS FROM THE PRE-9/11 AND GWOT LOGIT MODELS

The retention decisions of Marine aviators who were eligible to separate between FY1995 and FY2001 (Pre-9/11) and between FY2002 and June 2005 (GWOT) are evaluated independently. A simple comparison of the Pre-9/11 and GWOT deployment models shows that the Pre-9/11 models were not as descriptive as the GWOT models; only a handful of variables were significant in the Pre-9/11 models, while nearly two-thirds of the variables were significant in the GWOT models. Table 6.11 provides a comparison of the significance of the variables from the two samples.

The *age* and *age-squared* variables are not significant in the Pre-9/11 model, but they are significant in the GWOT model. This is mostly likely due to the GWOT sub-sample being older on average than the Pre-9/11 group. Race is not significant in either sub-sample. The *Female* variable was not included in the Pre-9/11 model because there were no female aviators in that sub-sample. The marital status and dependency variables have mixed results comparatively. The *MWC* variable is significant in both groups, and *MNC* is not significant in either group. But while the *SWC* variable is not significant in the Pre-9/11 group, it is positive and significant in the GWOT group.

The *Prior_Enl* and *FAC* variables are not significant in either sub-sample. However, the *WTI* variable is significant in both groups. The type of aviator variables are not jointly or individually significant in the Pre-9/11 model, but they both individually and jointly significant in the GWOT model. The reason for these variables not being significant in the Pre-9/11 model may be the equity in the number of deployments between all three types of aviators. The GWOT period does not have the same equity of deployments; rotary wing pilots deploy more frequently than fixed wing pilots.

Economic factors are not individually significant in the Pre-9/11 model, but they are individually significant in the GWOT model. The present value of ACP is significant in the GWOT model most likely because it has been increased and targeted at those groups with the lowest retention, namely rotary wing pilots. The number of pilots hired by the airline industry is most likely significant in the GWOT model because many more aviators are enticed by the industry. These Marines view the GWOT as being indefinite

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in nature, which causes their lives to lack stability. GWOT period aviators most likely view the civilian airline industry as providing more stability compared to the Marine Corps. Because of this, the airline industry is more likely to have an effect on retention in the GWOT period than the Pre-9/11 period.

The majority of the deployment-type variables are not significant in the Pre-9/11 model; only the variables for one non-hostile deployment (*N1*), multiple hostile deployments (*H23*), zero non-hostile and at least one hostile deployment (*N0H*), and one non- and zero hostile deployments (*N1H0*) are significant. By contrast, in the GWOT model, all but one of the deployment-type variables are significant, with the variable for one non-hostile deployment (*N1*) being the only deployment-type variable not significant. The reason for the difference in the significance of the deployment variables is most likely due to the increased frequency of deployments in the later period. The aviators in the GWOT period have more frequent episodes of deployment and fewer individuals with no deployments at EAOS than Pre-9/11 aviators. As discussed in Chapter III, 30.6% of GWOT aviators had more than two deployments compared to only 18.6% of Pre-9/11 aviators, and only 10.6% of GWOT aviators had zero deployments compared to 15.1% of Pre-9/11 aviators.

The effects of the deployment variables differ from the results of similar studies conducted previously, particularly the Hosek and Totten (2002) study. This thesis sought to replicate and update the Hosek and Totten (2002) study. Hosek and Totten's (2002) approach differs from this thesis primarily with respect to the definition of deployment. Hosek and Totten (2002) defined a deployment as occurring when Family Separation Allowance or Imminent Danger Pay are received. While these special pays do indicate that the service member was away from home for at least 30-days, they do not indicate whether the service member was participating in an OCONUS deployment or a CONUS training exercise. The sociological impact on the service member varies greatly between OCONUS deployments and CONUS training exercises, with OCONUS deployments having a much greater sociological effect. This thesis defines deployment as at least three consecutive months of Family Separation Allowance or at least two consecutive months of Imminent Danger Pay. This definition is more in line with qualification for the

Sea Service Deployment Ribbon, which is generally accepted by Marines as an indicator of deployment. With their broader definition of deployment, Hosek and Totten (2002) found that deployments have a positive effect on retention.(Hosek and Totten 2002, i) The more precise definition of deployment used in this thesis reveals that prior to 9/11 deployments did not affect retention unless the number of deployments failed to meet the expectations of the Marine or the duty included multiple hostile deployments. This thesis also updates the Hosek and Totten (2002) study, which evaluated retention behavior in the 1990s, by showing that since 9/11 deployments have had a negative effect on the retention of Marine aviators.

Table 6.11   Comparisons of Variables in the Pre-9/11 and GWOT Logit Models

Variables	Pre-9/11 (N=1,531)	GWOT (N=1,231)
Age	NS	S
Age Squared	NS	S
Minority	NS	NS
Female	OMITTED*	NS
ROTC	NS	NS
OCS	NS	S
Prior_Enl	NS	S
RWP	NS	S
NFO	NS	S
WTI	S	S
FAC	NS	NS
PV_thou	NS	S
Hires_thou	NS	S
MWC	S	S
MNC	NS	NS
SWC	NS	S
D1	NS	S
D2	S	S
D3	NS	S
N1	S	NS
N23	NS	S
H1	NS	S
H23	S	S
N0H	S	S
N1H0	S	S
N1H	NS	S
N23H0	NS	S
N23H	NS	S

S = Significant at least at the .10 level   NS = Not Significant at least at the .10 level

* *FEMALE* is omitted from the Pre-9/11 models because no females exist in the sample.

SOURCE: Author

E. COMPARISON OF THE PRE-9/11 AND GWOT PARTIAL EFFECTS RESULTS

A comparison of the results of the partial effects for the Pre-9/11 and GWOT groups shows dissimilarities between most variables. The Pre-9/11 models shows only six variables being significant, while 21 variables are significant in the GWOT models.

The variables that are significant in both samples are *MWC*, *WTI*, *N23*, *H23*, *N0H*, and *N1H0*. The *MWC* and *WTI* variables are very similar in effect, with both variables being positive for both samples. The *MWC* variable has 2.8 percentage points more of an effect in the Pre-9/11 models than in the GWOT models, and the *WTI* variable is 4 percentage points higher in the Pre-9/11 models than in the GWOT models. The other significant variables that are common in both samples are the deployment-type variables *H23*, *N0H*, and *N1H0*. The sign of the effect of multiple deployments (*H23*) is different between the two groups; *H23* has an +18 percentage point effect on retention in the Pre-9/11 model, and a -4.6 percentage point effect on retention in the GWOT model. The effect of the *N0H* variable also has a different sign in each of the samples. In the Pre-9/11 sample, *N0H* has a +13.46 percentage point effect on retention behavior, while it has a -13.67 percentage point effect in the GWOT sample. The *N1H0* variable, however, has the same sign in both groups, but differs in magnitude of the effect. The *N1H0* variable has a -9.4 percentage point effect on retention in the Pre-9/11 models and a -22.5 percentage point effect in the GWOT models.

VII. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

This thesis separately evaluated the effects of deployment on the retention of Marine aviators before 9/11 and after 9/11. The factors that affected the retention behavior of Marine aviators prior to 9/11/2001 do not appear to be the same as those that affect retention behavior after that date. In particular, the effect of deployments has become a significant factor in making the retention decision since the beginning of the GWOT. For the purpose of this thesis, a deployment is defined as having received three consecutive months of Family Separation Allowance or two consecutive months of Imminent Danger Pay.

Prior to the 9/11/2001 attacks on the World Trade Center and the Pentagon, the mean retention rate for Marine aviators was 97%. Since 9/11, the mean retention rate of Marine aviators has fallen to 66%. Prior to 9/11, the Marine Corps deployment cycle consisted of six months deployed followed by eighteen months at home. Since 9/11, the deployment cycle consists of seven months deployed followed by seven months at home. The increase in OPTEMPO since the beginning of the GWOT indicates that aviators can expect to deploy more frequently than they did prior to 9/11. As noted in Chapter III, 66% of the GWOT period aviators had two or more deployments prior to EAOS compared to only 56.5% of Pre-9/11 period aviators who had this many deployments. Similarly, 10.6% of GWOT period aviators had zero deployments prior to EAOS, while 15.1% of Pre-9/11 aviators had not deployed prior to making the retention decision. This deployment distribution indicates that GWOT period aviators deploy more frequently than Pre-9/11 aviators, which leads to the appearance of increased OPTEMPO since the beginning of the GWOT.

Because of the increased OPTEMPO and the increased frequency of deployments, it is necessary to evaluate the effects of deployments on Pre-9/11 and GWOT aviators separately. The analysis was conducted using three multivariate logistic regression models for each period. The first model evaluated the effects of the total number of deployments on retention behavior utilizing dummy variables for zero deployments, one

deployment, two deployments, and more than two deployments. The second model evaluated the effects of non-hostile and hostile deployments independently utilizing dummy variables for zero non-hostile deployments, one non-hostile deployment, multiple non-hostile deployments, zero hostile deployments, one hostile deployment, and multiple hostile deployments. The third model evaluated the effects of combinations of non-hostile and hostile deployments on the retention behavior of Pre-9/11 and GWOT period aviators.

The results of the deployment models for the Pre-9/11 period aviators indicate that prior to 9/11, deployments had a limited effect on the retention behavior of Marine Corps aviators. The results of the first model indicate that the total number of deployments did not affect the retention decision of Pre-9/11 aviators. The results of the second deployment-type model indicate that only indicators for one non-hostile deployment and multiple hostile deployments are significant. For Pre-9/11 aviators, it appears that individuals who have only one non-hostile deployment are less likely to stay than individuals with zero non-hostile deployments. Also, individuals with multiple hostile deployments appear to be more likely to stay than individuals with zero hostile deployments. These results are extended by the results of the third model. For the combined deployment-type model, indicators of aviators with zero non-hostile and multiple hostile deployments (*N0H*) and one non-hostile and zero hostile deployments (*N1H0*) had significant and positive effects on the retention behavior of Pre-9/11 aviators. Pre-9/11 aviators with one non-hostile and zero hostile deployments are less likely to stay than aviators with zero deployments.

The results of the combined deployment-type model are consistent with the results of the independent deployment-type model for Pre-9/11 aviators. Both models appear to indicate that aviators with only one non-hostile deployment are relatively less likely to stay. The majority of the aviators in this period experienced two episodes of deployment and those aviators who experienced less than two deployments may have been dissatisfied with the quantity of deployments they experienced. This appears to have led these aviators to separate.

Both models also show that Pre-9/11 aviators responded favorably to hostile deployment, particularly multiple episodes of hostile deployment. The results of these models indicate that aviators who had multiple episodes of hostile deployment were more likely to stay than Pre-9/11 aviators who had zero episodes of hostile deployment. This is most likely the result of the Marine Corps ethos. The Marine Corps is recognized for its fighting abilities, and Marines hunger for the opportunity to evaluate themselves in combat situations. During this period, combat was rare and experiencing combat may have left participants with a feeling of satisfaction which positively affected their retention behavior.

GWOT period aviators appear to have deployed more frequently than Pre-9/11 aviators. The results of the analysis reveal that the increased OPTEMPO is negatively affecting the retention behavior of GWOT period aviators. The same three models used for the Pre-9/11 period were applied to the GWOT period for comparative analysis. For the GWOT period, nearly all deployment-type indicators are negative and significant. The results of the first model indicate that the total number of deployments has a negative effect on the retention decision. The results of the second model indicate that multiple non-hostile deployments and any number of hostile deployments have negative effects on retention. GWOT period aviators with multiple non-hostile deployments are less likely to stay than aviators with zero non-hostile deployments. Similarly, GWOT period aviators with one hostile deployment or multiple hostile deployments are less likely to stay than aviators with zero hostile deployments.

The third model with interacted variables again indicates that deployments negatively affect retention among GWOT period aviators. GWOT period aviators with zero non-hostile and at least one hostile deployment are less likely to stay than aviators with zero deployments. GWOT period aviators with one non-hostile and zero hostile deployments are less likely to stay than aviators with zero deployments. GWOT period aviators with one non-hostile and multiple hostile deployments are less likely to stay than aviators with zero deployments. GWOT period aviators with multiple non-hostile and zero hostile deployments are less likely to stay than aviators with zero deployments.

Finally, GWOT period aviators with multiple non-hostile and multiple hostile deployments are less likely to stay than aviators with zero deployments.

All of the GWOT period deployment models indicate that any episode of deployment has a negative effect on the retention behavior of aviators in this period. This is very different than the results form the Pre-9/11 period and is most likely due to the effect of the Global War on Terror. Prior to 9/11, Marine aviators had a deployment schedule that was set years in advance. This schedule was used as a career-planning tool for Pre-9/11 aviators. The Pre-9/11 period was also marked by relative stability in the world. Since 9/11, the deployment schedule is constantly modified and adjusted to meet real-time needs and demands. The GWOT period is also marked by a great deal of uncertainty, which revolves around the GWOT itself. There is no end in sight for the GWOT and Marine aviators can expect to continue to deploy at the current OPTEMPO indefinitely. The indefinite nature of the GWOT may have contributed to the lower retention rate of GWOT period aviators.

The results of this thesis differ from results of previous studies, particularly the Hosek and Totten (2002) study. The Hosek and Totten (2002) study determined that deployments positively affected the retention decision of first-term enlistees in all four services. (Hosek and Totten, 2002, 104). This thesis reveals that the results of the Hosek and Totten (2002) study may not be appropriate for use in the GWOT period. The difference in the results of the two studies can most likely be attributed to the time periods observed and the definitions of deployment used by each study. The Hosek and Totten (2002) study evaluated retention behavior in the 1990s and defined retention as one or more months of receipt of either Family Separation Allowance or Imminent Danger Pay. This thesis evaluated retention behavior in the GWOT period and defined retention as three or more consecutive months of Family Separation Allowance or two or more consecutive months of Imminent Danger Pay. The time period and the more specific definition of deployment are the most likely reasons for the difference in results revealed by this thesis.

B.   RECOMMENDATIONS

In order to mitigate the negative GWOT effect on retention, the Marine Corps needs to add some stability to its current force. The Marine Corps should look at its Pre-9/11 status in order to determine what measures need to be undertaken to remedy the retention problem in the aviation community. These measures should ensure the stability of the deployment cycle for both squadrons and individuals. This will most likely help to minimize the effect of the Global War on Terror on the retention behavior of Marine Corps aviators.

This study evaluated the retention decision of Marine aviators from FY1995 through FY2005. The focus of the study was the effects related to the GWOT and increased OPTEMPO. A limited amount of data were available to evaluate aviators making the retention decision in the GWOT period. The Marine Corps would be best served to continue to evaluate aviators, and all other officer MOS, making the retention decision in the GWOT period as more time passes and more data become available. The Marine Corps should also adopt a more accurate definition for deployment, such as the one used in this study, for analysts to use when conducting research. This will enable Marine Corps leadership to better understand the research that is being conducted and will also allow researchers to produce more accurate and consistent results.

Based upon the results of this research, it is clear that the Marine Corps must take steps in order to counter the decrease in aviator retention. The following recommendations involve individual rotations, career paths, and the service obligation and offer some prospect of improving retention in the GWOT period.

The first recommendation is to base the first Fleet squadron tour on deployments rather than years and limit the first tour to two deployments. Prior to the GWOT, Marine aviators expected to deploy twice before being eligible to transfer. The majority of Pre-9/11 aviators deployed twice prior to EAOS and their retention rate was 97%. Since the GWOT, Marine aviators are expected to deploy at least three times before becoming eligible to transfer. The majority of GWOT period aviators have more than two deployments prior to EAOS and have a retention rate of only 66%. The increased number of deployments of GWOT period aviators creates an added hardship on the

aviator and his or her family. Coupled with the increased OPTEMPO, the GWOT period aviator can expect to spend the majority of his or her first three or four years OCONUS, and most likely in combat. This may lead to the exhaustion of many individuals. In order to limit this effect, the Corps should examine limiting the first Fleet tour to two deployments. A two deployment initial tour would align the GWOT period initial squadron tour more closely with that of the Pre-9/11 period. Since deployments had little effect on retention behavior prior to 9/11, limiting the number of deployments for GWOT period aviators to two may help limit the number of these aviators who choose to separate.

The second recommendation involves aviators who are completing non-Fleet tours and preparing to change duty stations. These individuals should return to deploying squadrons immediately following the non-deploying tour. Individuals in this category may include those in non-flying billets as well as those in non-deploying flying billets. Individuals in the first category include those attending Resident Professional Military Education (PME) or the Naval Postgraduate School (NPS), Military Officer Instructors (MOIs), Officer Selection Officers (OSOs), and those on non-deploying FAC tours. Individuals in the second category include pilots from HMX-1, Marine Aviation Weapons and Tactics Squadron – 1 (MAWTS-1), flight school, and the various Fleet Replacement Squadrons (FRS). All of these individuals have spent one tour in non-deploying billets and have been afforded time to rest and recuperate from any previous time spent in the Fleet. These aviators are mentally and physically ready to replace aviators in Fleet squadrons in order to afford them the opportunity to rest and recuperate. By having these aviators replace those completing their second deployment, the Marine Corps will allow itself to maintain the operational readiness levels necessary to be combat effective. This allows for a one-for-one swap of aviators from non-flying billets for those returning from their second deployments.

The third recommendation is to encourage non-traditional career paths for aviators. The current career path for an aviator is to remain in Fleet squadrons as long as possible and to return to the Fleet as quickly as possible. It is highly discouraged for an aviator to seek out non-traditional career paths such as attending NPS or becoming an

MOI or OSO. These billets remove the aviator from the cockpit for an extended period of time and have historically been frowned upon by the aviation community. In order to allow aviators an opportunity to rest and recover from the current deployment cycle, non-traditional career paths such as these can become valuable tools. By encouraging alternative career paths, the Marine Corps will be "officially" telling Marine aviators that it is acceptable for them to pursue goals outside of the cockpit. This prevailing negative impression of duties outside of the squadron gives young aviators the feeling that alternative career paths are career ending. If this general impression of alternative career paths were to change in the aviation community, then more aviators would see that there are opportunities outside of the squadron. GWOT period aviators appear to have a low retention rate due to the increased OPTEMPO and uncertain future. By encouraging alternative career paths, the Marine Corps will give these young aviators some certainty while also giving them a break from the OPTEMPO. If afforded the opportunity to attend graduate school or participate in MOI or OSO programs armed with the knowledge that participating in these programs is not going to be detrimental to career progression, it is likely that more aviators will choose to stay in the Marine Corps. If young aviators view alternative career paths as viable options, more may choose to stay in the Marine Corps and continue with their aviation careers.

The fourth recommendation is to increase the length of the active duty service obligation for Rotary Wing Pilots (RWPs) and Naval Flight Officers (NFOs). Currently, RWPs and NFOs have a six-year obligation upon completion of flight school, while Fixed Wing Pilots (FWPs) have an eight-year obligation. For FWPs, this eight-year obligation requires them to stay in the Marine Corps until they reach approximately eleven years of service. At this point, they are "over the hump" and are approaching retirement, which acts as an incentive to keep them in the Marine Corps. RWPs and NFOs generally have eight years of service at the decision point. At eight years of service, retirement seems a long way off and is not as large an incentive to stay as it is for FWPs at the decision point. This is shown by the highly negative effect that being either an RWP or an NFO has on the retention decision. The GWOT deployment models show that RWPs and NFOs are less likely to stay than FWPs by 25 to 30 percentage points.

Because of this, the Marine Corps should take steps aimed at enticing more RWPs and NFOs to stay. Recruiting may be negatively affected by increasing the length of service obligations; however, many of the individuals who sign aviation contracts are not concerned with the service obligation. Most individuals who sign aviation contracts prior to attending officer training programs have expectations of becoming jet pilots who have an eight year commitment. These individuals will most likely not be affected by an increase in the service obligation of Rotary Wing Pilots and Naval Flight Officers; therefore, recruiting of aviators is not likely to be negatively affected. By increasing the length of service obligation, not only will the Corps get two extra years of service from its RWPs and NFOs, it will also see an added retention benefit because retirement will serve as more of an incentive for these aviators to stay.

The final recommendation involves restructuring Marine squadrons slightly. This recommendation is to pull one squadron per platform from each Marine Aircraft Wing (MAW) out of the deployment cycle. Let these squadrons become an "Advanced FRS" where new co-pilots obtain their initial combat qualifications (i.e. Terrain Flight, Night Systems, Defensive Maneuvers, and Aerial Gunnery). Pilots returning from their second deployment can rotate into one of these squadrons as instructors in order to obtain relief from deploying. This allows aviators who have been deploying to leave the deployment cycle. It also allows those squadrons in the deployment cycle to focus on the deployment rather than on training new aviators in preparation for deployment. Currently, much of the time squadrons spend at home is not actually at home. Most of this time is spent on squadron training exercises ensuring that all of the squadron aviators are fully qualified prior to deployment. Once deployed, the squadron does not have the time or assets necessary to train young aviators; it must focus on accomplishing the tasks at hand. By installing an "Advanced FRS" with each MAW, the PERSTEMPO for individual aviators can be reduced and squadrons can be assured of being fully combat qualified and capable of carrying out missions when deployed.

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